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THE WATERSIDE STATION.

During the present month a large part of our space has been devoted to the description in detail of the new Waterside station of the New York Edison Company, and the system of that corporation in general. We had hoped to publish the closing installment this week, accompanied by a very elaborate map of the whole low-tension network of the company in Greater New York, but unfortunately our engravers have not quite been able to get their work done in time. The final installment will, therefore, appear next week, and will constitute one feature of an unusually interesting and important Export Issue.

INCOMBUSTIBLE CARS.

Since our publication last week of the preliminary announcement of the general plans of the New York Central Railroad for the use of electric traction in the terminal tunnel and on commuter service as a whole, very little, if anything, has been vouchsafed as to the details of the schemes of the management. Things are, however, in a much more satisfactory shape than they were. Heaven knows, the new capital being raised, ostensibly for the purpose, is far more than adequate, and it would really seem that some other larger enterprise may be afoot, such as acquiring control of the Manhattan Elevated. Time will show. Meanwhile, another gratifying disclosure—no secret to our readers—is that Mr. Bion J. Arnold is now retained in the Central service to deal specifically under the direction of Chief Engineer Wilgus, with problems of electrical operation. As a matter of fact, Mr. Arnold has been studying the situation for some time past, and we can but heartily commend the selection. The Western record in heavy traction of this progressive and earnest young electrical engineer is the best augury for the new work.

Attention is called elsewhere in these pages to the remarkable and interesting discussion stirred up by Mr. George Westinghouse by newspaper correspondence, on the subject of safety in electric traction. That distinguished engineer and inventor suggests an ideal in incombustible cars and generally improved safeguards, toward which every aim must indeed be concentrated. The evils and dangers of fire from electric lighting are still far too great to be viewed with unconcern by any electrical engineer, and the art of electric traction cannot afford to have its progress hindered in the same manner. The discussion started by Mr. Westinghouse does, indeed, open up a large number of such questions of importance to the electrical industry, and, we believe, cannot but help bring nearer the time when electric traction will not only be universal but the safest means of locomotion on earth for all classes of service.

THE NORTHWESTERN ELECTRICAL CONVENTION.

The regular winter meeting of the Northwestern Electrical Association, held at Milwaukee last week, demonstrated more than ever the importance of that convention to the small electric lighting companies, not only of the territory which it covers, but of the whole country. The discussions at the Northwestern convention this year were better than ever, and will appeal to the smaller electric light companies to a degree not as yet attained by the proceedings of any other similar body, even though containing little of value to the professed engineer. The discussions covered such a wide range of sub-

jects that we can but call attention to a few of the notable points here, leaving fuller consideration of them until later.

The competition of small gasoline lighting plants installed by individual consumers received little attention compared to what the same subject did a year ago. The report of the committee on gasoline lighting submitted at the summer meeting did not reveal a very alarming state of affairs for electric light companies. Indeed, aside from this the discussion last week brought out clearly that convenience is what customers want rather than mere cheapness; otherwise electric lighting would never have gained a foothold against the incomparably cheaper light obtained from kerosene lamps. As long as central stations can offer reliable light free from bother to customers they need have no fear of the competition of illuminants calling for care and trouble on the part of the user.

The paper by Mr. Rau outlined a three-phase 4500-volt system for lighting, with delta connection for power transformers and 2000-volt star-connections between the three phases and neutral for light. Indeed, it looks as if such a system might easily become the standard for general light and power distribution in moderate sized towns, it is finding such an increasing number of advocates. With such a system Mr. Rau considers that the depreciation due to the advance of the art will not be nearly as rapid as it has been formerly in the electric lighting business. The discussion of this paper brought out one point upon which there is good reason to expect development the next few years, namely, the perfection of magnetic clutches which will allow polyphase motors to be run continuously on elevator and variable service of all kinds. In such case the manipulation of the clutch would correspond with the ordinary control used with direct-current motors.

Death by Electricity.

In a communication appearing in this week's Correspondence Columns, the question is raised as to whether a shock of electricity, as ordinarily received, really kills, and also the question as to whether in the electrocution of criminals, as practised in more than one State, the electrical execution really kills, as distinguished from the autopsy. In the first place, it is a matter of unfortunate experience that occasionally persons are killed by accidental electric shocks. That is to say, they receive a shock and fall down unconscious, and from this state they never revive, so that in the course of a certain number of minutes or hours there is no doubt in the minds of the most unskilled observer that the person is dead. In some cases, however, persons recover, either with or without the aid of assistants, such as artificial respiration and stimulants. The fact that artificial respiration sometimes restores suspended animation several hours after loss of consciousness by drowning, has raised the question from time to time as to whether similar treatment can restore animation to the electrically shocked.

As regards shocks accidentally received, efforts should always be made to resuscitate the unconscious victim of accident. The question as to whether he can be revived should be settled by trial, and failure not accepted until the case is clearly hopeless. In the case of electrocuted criminals, the conditions are entirely different. When a man receives an accidental shock the muscular contraction usually tends to throw him violently away from the contact. Moreover, the resistance of the accidental path through his body is usually high. The current he receives is, therefore, under ordinary circumstances, neither powerful nor prolonged.

Under the conditions of electrocution, however, the current application is relatively both powerful and prolonged. In fact, it is sufficient, at least in some cases, to raise the temperature of the body appreciably, owing to Joulean effect, and invariably produces lesions fatal to life. Considering the number of electrocutions that have been made since the existing New York State law went into effect, and the fulness with which the subject has been reported upon, there can be no question that the subject dies by the effects of the electric shock, and is dead beyond all hope of recovery before the autopsy takes place. We may remark that a very interesting article on the cause of death by electric shock by Dr. R. H. Cunningham, appeared on page 1003 of the *Electrical World* for Dec. 30, 1899.

The Function of the Condenser in the Induction Coil.

A communication in our Correspondence Columns relating to the changes which are produced in the operation of an induction coil when a condenser is used to bridge the vibrator, raises an interesting subject, the full theory of which has never been thoroughly worked out on the experimental side, owing, no doubt, to the great difficulty and complexity of the investigation.

It is quite clear, from elementary principles, that since the primary and secondary windings of an induction coil are mounted upon the same core, that, neglecting magnetic leakage, the induced e. m. f.'s in both are the same, except in regard to degree. In other words, any variation of magnetic flux in the common magnetic circuit of both induces the same e. m. f. per turn in both primary and secondary windings. If the number of turns in the primary and secondary windings were equal, the induced e. m. f.'s would be equal. Owing to the fact that in the ordinary induction coil the secondary winding has a much larger number of turns than the primary winding, the secondary induced e. m. f. may be very appreciable when the primary induced e. m. f. is relatively small. In either case, however, a primary induced e. m. f. exists. In fact, induction coils employed for exciting muscular stimulus in electro-therapeutic treatment are commonly provided with terminals, from which either the primary induced e. m. f. or the secondary induced e. m. f. can be obtained.

If no condenser is used to bridge the vibrator in the primary or battery circuit, the primary current is cyclically broken through the vibrator arc, and this means that the primary current tapers down to zero rather than falls to zero abruptly. When, however, a suitable condenser is connected across the vibrator, the rupture of the vibrator contact does not, or need not, interrupt the flow of current in the primary circuit. The primary winding may discharge into the condenser until the e. m. f. in the condenser first stops and then reverses the direction of flow. This automatic stopping and reversing usually means a much more sudden change of current than the interruption through the arc provides. Since the induced e. m. f.'s in both primary and secondary depend for their magnitude upon the rate of change of primary current, both induced e. m. f.'s will be magnified by the use of the condenser, and a primary winding, which will not light up a Geissler tube when no condenser is used, may light up the tube after the insertion of the condenser. Similarly, the sparking distance at secondary terminals is likely to be considerably increased by the use of the condenser. Since the magnitude of the induced e. m. f. depends upon the suddenness of change in magnetic flux and of current, the reason for the relatively enormous lengths of sparks supplied by the Tesla induction coil is at once evident. In the Tesla coil the number of secondary turns is comparatively small, but the primary winding is supplied with oscillatory currents of high frequency, i. e., currents which change very rapidly in magnitude.

THE COHERER IN WIRELESS TELEGRAPHY.

In his remarks at the recent annual dinner of the American Institute of Electrical Engineers, Mr. Marconi, in speaking of his work, rendered frank acknowledgment of the fact that it had been built largely on the work of others, and mentioned specifically Henry, Hertz, Maxwell and Kelvin. We believe it was a matter of general surprise, however, to those present, and doubtless to many who subsequently read the report of his remarks, that no reference was made to those who discovered and perfected the coherer. It is not too much to say that entirely upon the coherer the existing art of wireless telegraphy rests, and while none can dispute the credit due to Marconi for his pre-eminent part in perfecting a practical system of radiant telegraphy, no factor which he has incorporated in that system is, we believe, at all comparable in importance with the coherer. Indeed, without the discovery of this device the present wireless telegraphy systems would be as impossible as the electromagnetic telegraph would have been without the electromagnet. None will question the acknowledgment to Henry, who first experimented with rapid oscillations and their effects; to Maxwell, who built up the theory of electric waves, and to Hertz, who demonstrated their existence. But surely to Onesti, the Italian, and Branly, the Frenchman, who independently discovered the filings coherer, and particularly to the latter who as early as 1890 demonstrated its possibilities as a wave detector and generously offered to the world the free use of his work, should be assigned a large share—perhaps the largest—in an allotment of credit for the wireless telegraph system of to-day.

AS TO ELECTRIC HEATING.

As time has moved along there has been much comment that the commercial applications of electric heating have not become more extensive. Of course, the actual number of such applications has already become very large, but it is for the most part for very special purposes or on a small scale, although a few of the applications to the arts require considerable energy. The fact is that electric heating as a factor of station load is even now almost negligible. The art of electric heating, particularly in electric furnaces, has, nevertheless, progressed in a remarkable manner, but so far as the station manager is concerned it cuts little figure. Obviously, electric current is a roundabout and not very efficient way of obtaining heat, but it is, nevertheless, so convenient that it has very great merits for many purposes. It has been given a fair trial for cooking purposes, and has shown in that line a reasonable degree of economy. With the cost of current brought to the figures often reached in hydraulic transmission plants, an electric range is quite comparable with a gas range in operating expenses, and, indeed, in many instances would prove to be the lower of the two, for in cities of the smaller class gas is generally relatively higher than electricity. Similarly, electric heating has proved a great success in certain of the arts, saving more in labor than would offset any intrinsic expense in the method. Yet all these uses combined involve no very considerable output in any one place.

The only large use of electricity for low temperature heating is in electric cars, and this, as every one knows, is universal and highly successful. There is no other method of heating cars which can at all be considered a competitor on street railways. Now the essence of success in this instance is the well-known fact that after the car is once heated it can be kept hot with a very moderate expenditure of energy, even under the severe attacks of a Northern winter; and observation indicates that as a matter of fact electric cars are much oftener too hot than too cool. The recent strike in a Western city, when the enraged passengers refused to pay fare until the heat was turned on, is a source of innocent merriment because of its rarity. Now, there are many cases of domestic heating which could be treated electrically with positive economy and very great convenience, if there were a little encouragement given them. In every house, particularly in our smaller Northern cities, where fairly cheap power is available, there are a few rooms which require heat only in a moderate degree at irregular or sometimes regular intervals. Sleeping rooms in particular ought not, merely as a matter of hygiene, to be kept hot, and except in occasional instances a couple of hours a day would cover the time during which a quick-acting and direct source of heat like an electric radiator would be in use. This is a type of a very large amount of purely auxiliary heating that could very well be done electrically, and electrical methods would simplify the work wonderfully. If one started with such auxiliary heating in view the apparatus for warming a house would be improved in various ways. In the ordinary house of modest pretensions a hot-air furnace is the common method of heating with the addition of a few fireplaces, which are very rarely used regularly. If not very carefully planned, a hot-air furnace is notoriously bad in the matter of distributing its heat, and almost every house has at least one room that can only be heated by shutting off most of the other registers and driving the furnace at full power.

Now, with electric heating fairly available one could plan a furnace hot-air or steam so as to do the regular work of winter heating and to do it thoroughly well. A furnace, when driven too hard or not hard enough, is both troublesome to manage and inefficient. When proportioned to take care of moderate and uniform requirements it is both efficient and reliable. With a furnace properly proportioned for, say, eight rooms of a 16-room house, the saving during a winter run would probably provide a material balance to help offset the cost of electricity used irregularly in the other rooms. At ordinary prices electric heating would still be a luxury, but a very convenient and satisfactory one. Nothing else can put up the temperature on so short notice or hold it so steadily. In milder climates, where really cold days are rare, the occasional usefulness of electric heaters would still be greater and would obviate the necessity of other heating devices, or else supplement the simpler ones, like fireplaces, very efficiently. Electric heat is always ready to be turned on, gets to work quickly and is out for good when the switch is turned off. It is, of course, understood that for temporary or irregular heating the walls of a room should not be of low temperature when heat is needed, as otherwise some time will be required to raise the temperature of these, during which period the occupant of the room will not derive much warmth from the heater unless exposed to its direct radiations.

So far as the station manager is concerned the load produced and sold on the basis of motive power would be, for the most part, very desirable in character. It would not be subject to violent fluctuations, would be nearly non-inductive, and except for electrical cooking apparatus would not aggravate the lap load. Even in that case it would tend mainly to lengthen the peak, while in the morning and at noon it would help the load curve materially. The occasional heating of rooms would come at times generally advantageous to the station. Very possibly it may take a long time to bring electric heating into prominence, but we wish some enterprising manager of a transmission plant who can make a fairly low price for current and wants to build up a steady load would try on the electric heating proposition and see in how far it can be made commercially advantageous to himself and to the public.

The Marconi Wireless Atlantic Signals.

Mr. G. Marconi sailed for England on Wednesday by the International Navigation steamer "Philadelphia," to push the development of his work on both sides of the Atlantic. We gave last week his own story of the famous signals, and below is quoted the graphic narrative of Mr. Ray Stannard Baker, to appear in February *McClure's Magazine:*

At noon on Thursday (Dec. 12, 1901) Marconi sat waiting, a telephone receiver at his ear, in the old barracks on Signal Hill. To him it must have been a moment of painful stress. Arranged on the table before him, all its parts within easy reach, was the delicate receiving instrument, the supreme product of years of the inventor's life, now to be submitted to a decisive test. A wire ran out through the window, thence to a pole, thence upward to the kite which could be seen swaying high overhead. It was a bluff, raw day; at the base of ht ecliff, 300 ft. below, thundered a cold sea; oceanward through the mist rose dimly the outlines of Cape Spear, the easternmost reach of the North American continent. Beyond that rolled the unbroken ocean, nearly 2000 miles to the coast of the British Isles. Across the harbor the city of St. John's lay on its hillside wrapped in fog; no one had taken enough interest in the experiments to come up here through the snow to Signal Hill. Even the ubiquitous reporter was absent, but the faith of the inventor in his creation was unshaken.

"I believed from the first," he told me, "that I would be successful in getting signals across the Atlantic."

Only two persons were in the room—Mr. Marconi and Mr. Kemp. Everything had been done that could be done. The receiving apparatus was of unusual sensitiveness, so that it could catch even the faintest evidence of the signals. A telephone receiver, which is no part of the ordinary instrument, had been supplied, so that the slightest clicking of the dots might be conveyed to the inventor's ear. For nearly half an hour not a sound broke the silence of the room; then quite suddenly Mr. Kemp heard the sharp click of the tapper as it struck against the coherer—this, of course, was not the signal, yet it was an indication that something was coming. The inventor's face showed no evidence of excitement. Presently he said:

"See if you can hear anything, Mr. Kemp."

Mr. Kemp took the receiver, and a moment later, faintly and yet distinctly and unmistakably, came the three little clicks—the dots of the letter S, tapped out an instant before in England. At 10 minutes past 1 more signals came, and both Mr. Marconi and Mr. Kemp assured themselves again and again that there could be no mistake. During this time the kite gyrated so wildly in the air that the receiving wire was not maintained at the same height, as it should have been; but again, at 20 minutes after 2, other repetitions of the signal were received.

Thus the problem was solved. One of the great wonders of science had been wrought. On the following afternoon, Friday, he succeeded in getting other repetitions of the signal from England; but on Saturday, though he made an effort, he was unable to hear anything. The signals were, of course, sent continuously, but the inventor was unable to obtain continuous results, owing, as he explains, to the fluctuations of the height of the kite as it was blown about by the wind, and to the extreme delicacy of his instruments, which required constant adjustment during the experiments.

Electrical Engineers of the Day—XXX.

CALVIN W. RICE.

Mr. Calvin Winsor Rice was born in Winchester, Mass., on Nov. 4, 1868. He is of Puritan stock, descended from Governor Winslow, of the Massachusetts Bay Colony. Most of his early life was spent in the vicinity of Boston, Mass., and his education was obtained in the public schools of Massachusetts. Entering the electrical engineering course of the Massachusetts Institute of Technology in 1886, he was graduated therefrom with the class of 1890.

Previous to graduation Mr. Rice, in order to supplement his class instruction by practical knowledge, worked during summer vacations in the shops of the Thomson-Houston Electric Co., of Lynn, Mass., beginning as armature winder. In this manner he gained early in life the practical ideas which have so clearly shown themselves in his subsequent career. Shortly after Mr. Rice's permanent attachment to the Thomson-Houston Electric Company, he was assigned for duty with the motor department, and assisted in the work then being newly undertaken of adapting electric motors to many of the various kinds of work with which we are now all so familiar, but which in those days presented many problems for solution.

When the Thomson-Houston Electric Company consolidated with the Edison General Electric Company in 1892, and the present General Electric Company was formed, Mr. Rice was assigned to duty at the headquarters of the new company in Schenectady. There again he had the rare opportunity of assisting in new developments, as work was carried out on a much larger scale and polyphase apparatus was beginning to receive much more attention than had formerly been the case.

At Schenectady in 1894 he contracted typhoid fever, and after recovery was chosen in 1895 to fill the position of local engineer of the Cincinnati office of the General Electric Company, where he remained until 1896, when he was called to the position of electrical superintendent of the Silver Lake Mines, Silverton, Col. At these mines there was a power transmission system, the power plant situated on the Las Animas River, transmitting over a four-mile line to the mines at an elevation of 12,500 ft. above sea level.

After completing the extensions for the Silver Lake plant Mr. Rice went with the Anaconda Copper Mining Company as consulting engineer to Mr. Marcus Daly. In this position a great variety of work was performed by Mr. Rice, but his chief occupation was that of determining the engineering and commercial practicability of the development of certain water powers near Butte, Mont.

Mr. Rice returned to the East in 1898 and became the electrical engineer of the Kings County Electric Light & Power Company,

Brooklyn, and took part in the equipping of the station and a complete system of feeders and mains for an alternating system. The Kings County system was only partially completed, when a consolidation was effected with the Brooklyn Edison Company, and the two systems were merged. Mr. Rice then accepted a position as electrical engineer of the Consolidated Telegraph & Electrical Subway Company, which owns and operates the high-tension subways of the City of New York. In addition to this responsible position, which he still holds, Mr. Rice was also appointed chief of the meter and testing departments of the New York Edison Company, with headquarters at 53 Duane Street, New York. In these positions Mr. Rice has been assisting in the successful consolidation of several companies into one large system ,and has gathered an experience equaled by few engineers.

Mr. Rice has prepared papers for the National Electric Light Association at its conventions in 1898 and 1901, for the Boston Society of Arts and the Brooklyn Engineers' Club.

Mr. Rice is interested in literature, music and art, and these qualities as well as his never-failing courtesy have endeared him to a large circle of acquaintances and personal friends. He is a member of the American Institute of Electrical Engineers, of which he is at present a manager, a member of the finance and several special committees. He is the very efficient chairman of the Institute Committee on Papers and Meetings. He is also a member of the American Society of Mechanical Engineers and a corporate member of the Brooklyn Engineer's Club.

Electrical Equipment of the Manhattan Elevated Railway — III.

(*Concluded.*)

TRAIN EQUIPMENT.

IT is needless to say that the train equipment of the Manhattan system presented many problems of a magnitude not heretofore encountered in electric railway work necessitating for their solution an exhaustive study of the particular conditions of the road's traffic, and lengthy investigations of engineering factors and details of design. The motors are required to supply an enormous accelerating effort, and the high accelerating rate and frequency of stops imply an abnormal generation of heat, the dissipation of which must be provided for in the design. In addition are the vital questions of train control and braking. The preliminary trials demonstrated that the various problems presented by the conditions of service, and in the design of the apparatus had been most successfully solved in all of their details. In fact, the train equipment of the Manhattan may be considered to represent one of the most important pieces of engineering work of recent years, and reflects the highest credit on the engineers concerned.

In the study for the Manhattan equipment, the first point determined was the train weight. In place of the present five-car maximum for trains, it was decided to run six-car trains on the more crowded lines at the time of heaviest traffic. The next point determined was the schedule speed, this, with the number of stops, as already fixed by the location of existing stations, being the controlling factor in the size of motors and through them of the complete sub-station and main station electrical equipment, engines and boilers.

After investigating a large number of train characteristics with different rates of acceleration and braking, and different durations of acceleration, drifting and braking, a schedule of 14.7 miles per hour, theoretical, was chosen for the local service, based on an average of three stops per mile. This schedule was found to give best economy of power per ton-mile consistent with a moderate cost of electrical equipment; due regard being paid to an improvement of service over and above that given in the past by the steam locomotives, which, with five-car trains, only average a schedule speed of about 12 miles per hour.

The weight of a six-car train completely equipped with proper motors and controlling apparatus for this schedule, and with a standing load is about 154 tons. The train characteristic, or speed time curve, was based on an average run of 1775 ft. between stations, which run was to be made in about 68 seconds. The curve was laid out with power on for some 30 or 35 seconds, and with brakes on between 10 and 12 seconds; the balance of the 68 seconds' time being spent in drifting. The acceleration required before reaching the motor curve was 1.3 miles per hour per second, this acceleration remaining constant up to a speed of about 16 miles per hour, where it was assumed that the resistance would be all cut out, further acceleration being at a decreasing rate. The rate of retardation while braking was assumed at about two miles per hour per second.

With an average stop of 14 seconds at each station this train characteristic gave the required theoretical schedule speed of 14.7 miles per hour, with an estimated power consumption at the car of 77 watt-hours per ton-mile. From this train characteristic a cycle of duty for the motor equipment was developed, due regard being paid to the friction losses, which are estimated about 12 lbs. per ton, and to the rotary acceleration of the rotating parts, which worked out a value equivalent to the addition of 20 tons to the 154-ton train. It was found that the required effort would call for about 800 hp of motors per train.

At the time these calculations were made it was proposed to operate each train with two motor cars, one on each end of the train, and four trailers, each motor car to be equipped with four motors. The motors were, therefore, designed each to have sufficient power for the operation of ⅛ of the 174 effective-ton six-car train on the characteristic speed time curve outlined above.

After very exhaustive tests the motor designed by the General Electric Company, and termed the "GE-66," was chosen. Subsequent to the design of this motor the distribution of the motors through the train was somewhat altered. The original two motor car plan, which has been styled "double ended," was an admirable arrangement on the score of simplicity, and the utilization of well-tried controlling arrangements. But one single main conducting wire was to be run between the front and rear cars, the four motors in the rear car being connected in parallel with each other between this conducting wire and ground. The controller in the forward car was to operate in the usual series parallel way, connecting the four motors of the rear car first in series and afterward in parallel with the four motors in the forward car. For reversing, an electrically actuated reverse switch was to be used in the rear car, connected by small controlling wires with the forward car. Each of the two motor cars was to have a controller at one end, each of the two controllers on the six-car train being capable of handling all eight motors. While this was, undoubtedly, at the time considered the best method of handling this amount of power, a change was finally decided upon which would do away with the following disadvantages of the double-end system.

First.—The two large 800-hp controllers occupied valuable seating space above the car floor. Second.—Each motor car was obliged to carry sufficient rheostats for the control of all eight motors, half of these rheostats being normally out of service. Third.—More complicated switching when making up trains.

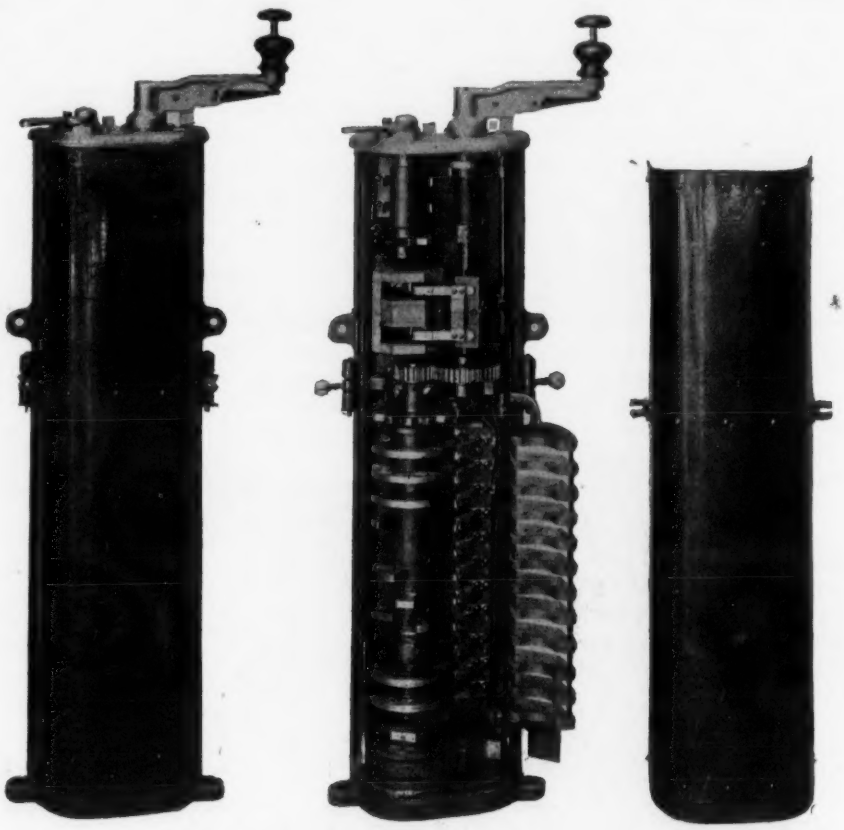


FIG. I.—MASTER CONTROLLER CLOSED AND OPEN.

On proof being obtained from extended trial on the Brooklyn Elevated system that this system of train control was sufficiently perfected for its safe adoption on such heavy and important service as that of the Manhattan Elevated, the double-ended system was given up, and the General Electric "Type M" system of control was chosen.

Eight motors being sufficient for a schedule of 14.7 miles, it was decided to redistribute them two on each of four motor cars. The make-up of trains will, as a rule, be as follows:

1. Motor car; 2. trailer; 3. motor car; 4. motor car; 5. trailer; 6. motor car.

Under this new arrangement each motor car is fitted with rheostats for its own pair of motors and with third-rail shoes for the collection of the current for its own pair of motors. The main controllers are all beneath the car floor, occupying no seating space.

In case a six-car train is split at its middle point into two three-car

trains, each component has a motor car at each end and no switching is necessary at terminals. The distribution of load on the structure and the possible tractive effort is also somewhat better than that of the double-ended system.

The motor weighs, complete with gear and gear case, nearly 4300 lbs. Structurally, it is of the unsplit box frame type, which has been found so successful in the 150-hp and 75-hp motor of the General Electric Company. The field frame consists of a single elongated cubical steel casting, into which the armature is inserted through a round opening of sufficient diameter in one end. To one side of this casting are bolted the axle boxes.

Eighteen hundred of these motors were ordered for 900 motor cars, making practicable the use of a number of special tools in the construction. The general appearance of the finished motor is shown in Fig. 5.

This type of motor has the advantage of a very rigid frame and the armature bearings are exceptionally large and long without sacrificing the length of the armature or commutator. The frame is fitted with unusually large ventilating openings, for which cover plates are provided, but which will, undoubtedly, be run open in the service of the Manhattan Company, on account of the dustless nature of this service, thus considerably reducing the temperature of the motor.

The armature is built on a hollow spider and fitted with spacers between the laminations, giving ventilating ducts exactly similar to those of a direct-current generator of similar size. It has 39 slots and 195 commutator segments, there being one turn per segment and ten conductors in each slot. Otherwise, the motor resembles the latest standard designs of General Electric railway motors, with certain refinements warranted by its size, the importance of its service and the quantities in which it is turned out.

The insulation is fireproof, the fields being insulated with asbestos wound on metal frames, and the armature bars with mica in spite of the fact that in the Manhattan service the temperature rise of the motors will be very moderate, giving an exceptionally low cost of maintenance. The gear reduction is 3.94, the ratio of teeth being 18 to 71. The efficiency is over 90 per cent between 140 and 200 amperes at 500 volts.

With 200 amperes per motor, eight motors will give the Manhattan train of 174 effective tons an acceleration of 1.5 miles per hour per second in place of the 1.3 called for by the train characteristic.

If the express trains are equipped with the same number of motors, they will reach free running speed of about 40 miles per hour on a level track with 550 volts. It is interesting to note, however, that the train control system allows the express trains to be made up of six motor cars, if desired, instead of four motor cars and two trailers, thus running up both the acceleration and the maximum speed.

Although the type M control system of the General Electric Company has been described several times heretofore in print, a brief resume of its principal features as built for the Manhattan Railway Company may be of interest here.

Each motor car is equipped with a series parallel controller, consisting of a number of separate magnetically actuated reversing switches. These contactors (Fig. 2) and the reversing switch take

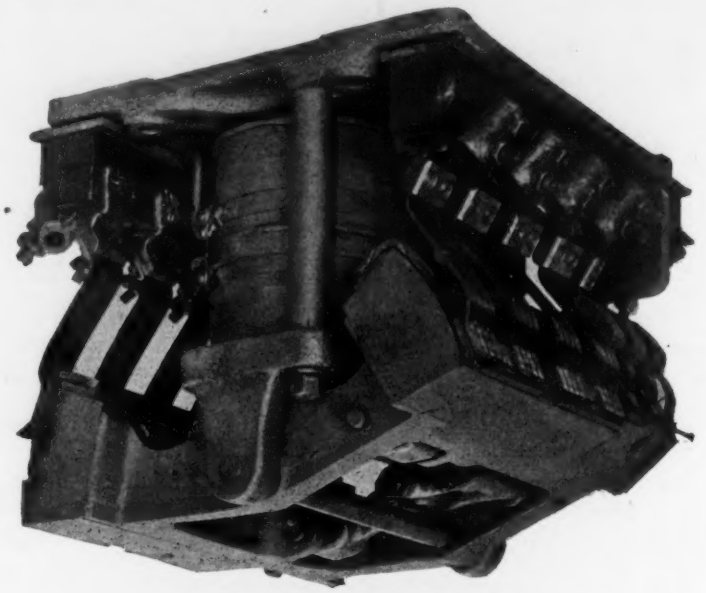
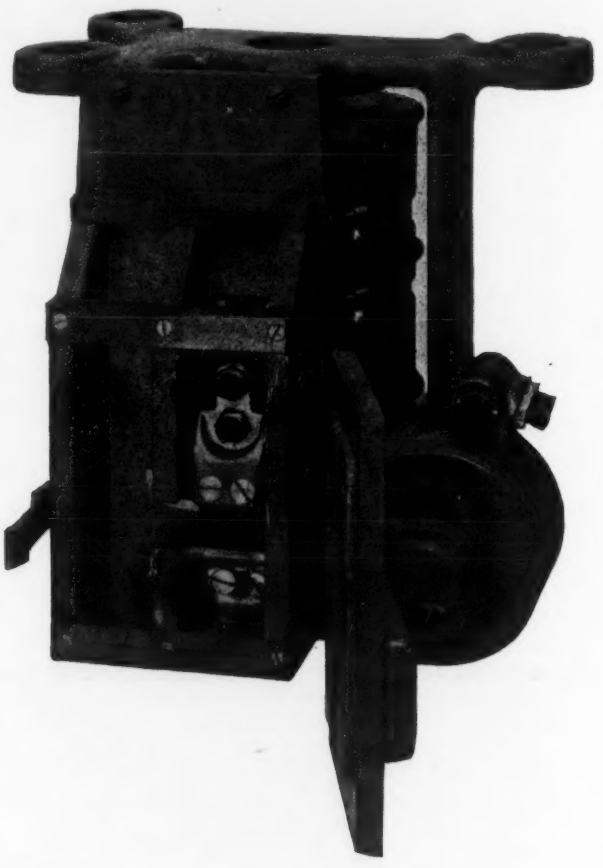


FIG. 4.—REVERSER.

the place of the usual controller cylinders, but are distinctly separate devices, which can be located at any convenient points without material reference to each other, and do not have to be combined in one case, as do the parts of one hand-operated controller. The contactors and reversing switch are distributed in most convenient locations under the car floor. The operation of these contactors accomplishes the same connections of motors, resistances, etc., as the operation of the usual controller.

There are 13 contactors on each Manhattan motor car, giving the various "notches" or separate connections, five in the series and five in the multiple position.



FIGS. 2 AND 3.—CONTACTOR.

The contactors are fitted with powerful magnetic blowouts, and with knuckle jointed moveable contacts, which give forcible rubbing contact on the closing and a large spring pressure to start the opening of the circuit when the contactor is released by its actuating magnet, the remainder of the opening movement being accomplished by gravity.

The contactors and reverse switch are conveniently arranged along the under side of the car body, with their doors opening out for convenient inspection from the side of the car.

The magnets actuating these contactors are connected to nine wires in a train cable, which is made continuous by means of couplers between the motor cars and trailers. Into these nine wires there are attached branches to a small master controller at each end of each motor car. These master controllers (Fig. 1) are connected to third-rail shoes and ground, and the operation of any one of them introduces current successively into different combinations of the nine wires in the train controlling cable, and thereby energizes the magnets of the contactors throughout the train. As the magnets of similar contactors in each of the motor cars are connected in parallel to the same wires in the train controlling cable, the similar contactors on each motor car act simultaneously with each other, making synchronous connections throughout the train. The motorman, therefore, has as perfect control of his entire equipment, from one to any number of motor cars, as has the motorman of an ordinary trolley car, the physical exertion of operating the one small master controller being even less than that of the usual surface street car.

The master controllers are fitted with so-called "dead man handles," of such a design that in case the motorman removes his hand from the handle a spring-operated auxiliary controller contact cuts off all power from the train-controlling cable, thus allowing all contactors throughout the train to open by gravity, cutting off power from all motors.

FIG. 6.—AIR COMPRESSOR AND MOTOR.

The cars are equipped with air compressors and governors also built by the General Electric Company. This consists (Fig. 6) of a two-cylinder pump direct coupled to a series-wound four-pole motor, the motor resembling in general construction the large one for operating the cars described above.

The two pump cylinders are horizontal and in line with each other on opposite sides of the crank, the plungers being one piece, thus giving a long plunger fit in the cylinder. The connecting rod connects one end of the double plunger to the crank. The piston displacement is 20 cu. ft. per minute at a speed of 300 r. p. m.

Each motor car is fitted with an air pump governor, designed to operate between any pressure between 80 and 100 lbs., and which will close the circuit on a reduction of about 10 lbs. from the opening pressure.

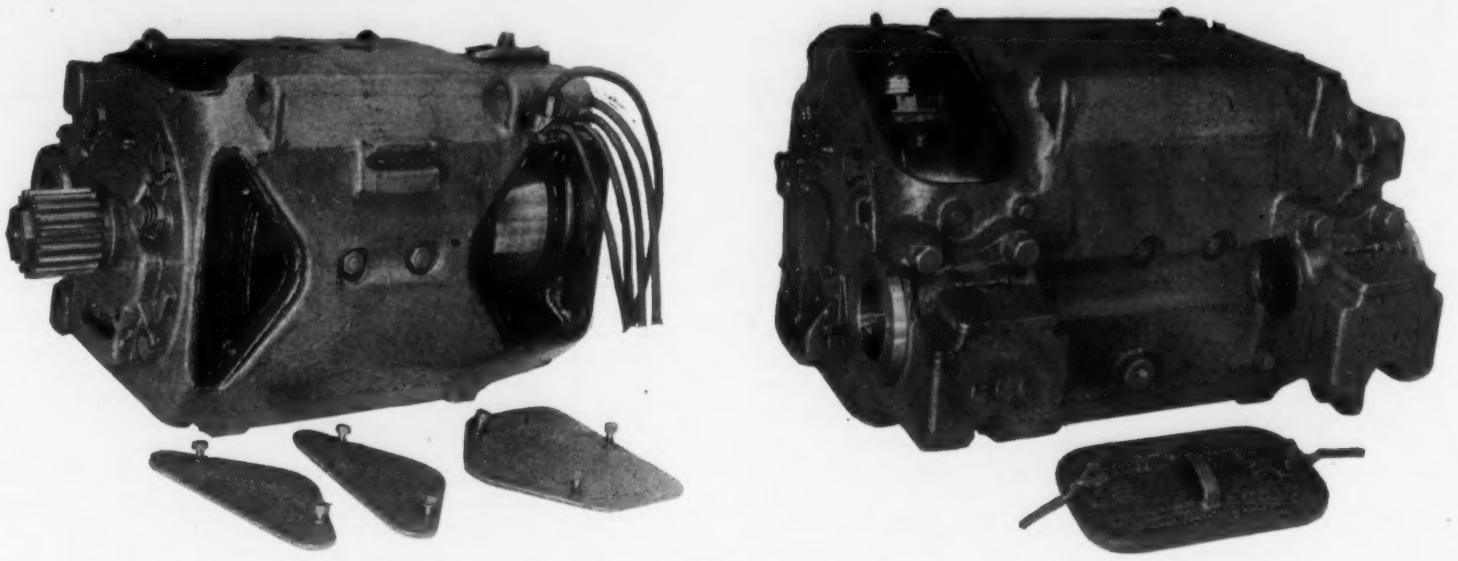


FIG. 5.—FRONT AND REAR VIEWS OF MOTOR.

The Cape Town-Cairo Telegraph Line.

Some interesting details are made public as to the construction of the British telegraph line from Cape Town to Cairo, planned by Mr. Rhodes, and giving an alternative land route to England over the Egyptian system. The line has now been completed as far as Ujiji on the eastern shore of Lake Tanganyika, so that messages may now be sent from Cape Town about 2500 miles north. The wire has been strung on insulated iron poles sent out from England. Of course, the wild nature of the country has made the work difficult, for it has been necessary to transport all material by human or animal portage for hundreds of miles. Five parties are engaged in the work, the total force averaging 10 white men and about 1200 blacks. The advance party, consisting of 2 whites and 200 natives, has charge of surveying the route and clearing a path for it about 15 ft. in width.

The second party follows two or three days after and widens the path to 60 ft., more or less, according to the nature of the country. It is easy to see why so wide a path is necessary. There will be no linemen every few miles, to keep the service in repair, and it will be far more costly than in civilized lands to mend a broken wire or repair other damages. Every preliminary caution, therefore must be taken.

Then comes the third party, which digs the holes; it is closely followed by the fourth detachment, which plants the posts, and finally come the wire stringers, who complete the work. None of the iron posts weighs less than 160 lbs., and most of them are 14 ft. high.

For some time the work has been carried on in German territory, as the line passes completely through the western part of German East Africa. It was necessary, of course, to secure the consent of Germany to build the line through its territory, and the Trans-African Telegraph Company, as it is called, agreed as a part of the bargain, to build a separate line across German East Africa from north to south, to be the property of the German Government and to be used wholly for the telegraph traffic of the German colony. The Government will connect its ports on the coast with the Ujiji station of the line.

This great enterprise will now be pushed northward into British East Africa and down the Nile as far as Fashoda, which is connected by wire with Khartum and Alexandria.

The Dry Cell.

By C. F. Burgess.

THE term "dry" cell, as applied to a certain class of generators of electrical energy, in common with the names applied to commercial product signifying eternal life and absolute perfection, calls to mind that familiar phrase, "what's in a name." It is a piece of apparatus occupying a place of no insignificant importance, and in spite of its faults, and by reason of some admirable qualities, it is extensively used. As a generator of electricity, its efficiency is low and its cost is high as compared with other open-circuit cells. The cost, however, is subservient to convenience, simplicity and portability.

The charm which the commercial names given and the claims made by some manufacturers might inspire are quickly dispelled upon use of the cells, and in some to a much greater degree than in others. The materials of which the dry cell is made are well known, and are the same in most of the types. The construction of the various cells is similar, and we might expect, therefore, the product of the different makers to be somewhat alike, as regards efficiency and durability. To determine whether this was actually the case some tests were made in the Applied Electro-Chemistry laboratory of the University of Wisconsin by Mr. A. A. Radtke, of the class of 1900. Six or more cells were obtained from each of a number of the principal manufacturers, and a summary of some of the results obtained from tests on the same are given herewith.

From the results of such tests some interesting conclusions may be drawn regarding the range of efficiencies which exists in different makes of cells, and we may also draw conclusions as to what service may be expected from a first-class cell.

The batteries were obtained as far as possible directly from the manufacturers, and those were selected for comparison which were the most comparable in size. The measurements extended over a range of about three months, and in order to compare the cells in different kinds of service they were submitted to continuous, intermittent and open-circuit duty. It was the object to make the tests commercial rather than scientific, and no chemical analyses were made to determine what action took place within the cells.

For the intermittent test the cells were all connected in series, there being three from each of eleven different manufacturers. By means of a clock the circuit was closed intermittently through a resistance, and

TABLE I.

Make of cell.	Internal resistance. Ohm.	No. of days test.	Open cir. e.m.f. after test.	Watt-hours delivered.	Watt-hours per cubic inch.
1.....	.28	76+*	.8	46.7	2.30
2.....	.28	76	0.	43.64	2.28
3.....	.18	76+*	1.18	58.39	2.74
4.....	.36	76+*	.95	47.72	1.96
5.....	.31	76+*	.84	37.86	1.98
6.....	.28	76+*	.91	46.96	2.55
7.....	.48	55	0.	22.68	1.38
8.....	.54	9	0.	3.28	.22
9.....	.41	76—	0.	32.94	1.39
10.....	.48	76—	0.	21.07	.92
11.....	.64	19	0.	10.01	.90

the current allowed to flow for one minute out of every ten. The current was maintained between one-tenth and two-tenths of an ampere. Measurements were made at frequent intervals for a period of 76 days, at which time the majority of the cells were out of service and the remainder showed signs of rapid deterioration. When measurements of e. m. f. showed that the cell while delivering current had dropped to zero, that cell was taken out of the circuit.

When first set up the highest open circuit e. m. f. was 1.55 volts and the lowest 1.16 volts. The lowest internal resistance was .17 of an ohm and the highest .68 of an ohm. The polarization with .2 ampere flowing varied from a negligible amount to .08 of a volt. Table I. will show the principal characteristics of the different makes of cells, each figure being the average readings on the three cells of each make tested. The cells of the different manufacturers are numbred 1 to 11, inclusive. Those marked by a * show that at the end of the test these cells were not completely exhausted, though the open circuit e. m. f. showed that they were on the downward path. In figuring the efficiencies, however, for these cells some allowance should be made for this fact.

It was noticeable that the three cells of each manufacture showed a considerable degree of uniformity between them, and in only one instance was there a marked discrepancy. The column giving watt-hours per cublic inch of the cells is perhaps the best one for comparison, though this is not absolutely so from the fact that the larger cells seem to have a higher efficiency or output per cublic inch of contents than the smaller size. The exact influence of the size of the cell on the capacity was not especially investigated. From this table it is evident that there may be a very large difference in value received for a given expenditure of money in dry cells, depending upon the choice of the cell used.

From polarization measurements it was evident, as would be expected, that the cells which polarize least are the cells which have the largest carbon area, and those having the fluted or corrugated

TABLE II.

Make of cell.	Open cir. e.m.f. after 27 ampere-hours output. Volts.	E. M. F. after 18 hours recovery. Volts.
1.....	.57	1.03
2.....	.08	.80
3.....	.05	.02
4.....	.27	.78
5.....	...	...
6.....	.8	.92
7.....	.52	.89
8.....	.04	.19
9.....	.20	.85
10.....	.0	.0
11.....	.0	.0

carbon of good size usually showed the highest efficiency. The cells having the highest internal resistance were found to have a layer of strawboard next to the zinc and interposed between the two electrodes. This use of the strawboard seems to be objectionable from its effect on the internal resistance and in causing a very uneven corosion of the zinc and low energy output.

Defective workmanship was apparent in a number of the cells, as illustrated in one case where the pitch used in sealing the top had been allowed to run down inside the zinc cylinder and protected most of this electrode from action. This caused the zinc exposed to become perforated at an early stage of discharge, allowing the electrolyte to escape and greatly reduce the output.

Amalgamation of the zinc seems to have a beneficial action in making the corrosion more uniform, and thus preventing puncture. About one-half of the cells tested showed evidence of having been amalgamated.

The continuous test to which the cells were subjected consisted in connecting 22 cells in series, there being two of each make. The current at the beginning of the test was .275 ampere, which steadily decreased in value, and the test was discontinued when 27 ampere-hours had been delivered. The circuit was then opened and the recovery of the cells was observed. Table II. shows the relative values of the different cells on continuous service.

TABLE III.

Make of cell.	Beginning. Volts.	After 70 days. Volts.
1.....	1.54	1.51
2.....	1.43	1.40
3.....	1.42	1.40
4.....	1.47	1.42
5.....	1.20	1.16
6.....	1.44	1.42
7.....	1.52	1.48
8.....	1.56	1.52
9.....	1.44	1.40
10.....	1.46	.96

The effect of standing on open circuit for a considerable length of time upon the e. m. f. of the cell is indicated in Table III., where each cell shows a slight decrease in pressure when allowed to stand for two or three months. This gives only an approximate indication of the deterioration of the cell, for the capacity of the cell may

have decreased to even a greater extent than the figures show. It is evident that the time for this test was not sufficient to show any marked decrease in the value of the cell when not in use.

Another test was made to determine the effect of the temperature on the e. m. f. of a dry cell, and it appeared that the ordinary variations of the temperature to which it is subjected in use does not change the pressure more than a few hundredths of a volt, and that an extreme rise of 70 degs. C. increases the e. m. f. about one-tenth of a volt. The two cells which were tested resumed the original e. m. f. when allowed to cool to atmospheric conditions.

Before and after the intermittent life test each cell was carefully weighed, and the majority of them showed a slight increase in weight after discharge, somewhere between three to ten grams, while a few showed a slight decrease. Three cells of one make showed a loss of over 100 grams each. An explanation of this loss or gain of weight during discharge was not attempted, and it would require a careful consideration of the chemical changes within the cell and the methods of construction to afford such explanation. The change of weight seems to have little or no relation or bearing on the efficiency or durability of the cells.

From the results of this work it is shown that where any considerable amount of money is to be invested in the purchase of dry cells, tests of efficiency are of much greater value than in most forms of electrical apparatus. It is true that the tests which have here been outlined may not show the absolute relation of the different makes for an entirely different class of service, but they at least give an approximate relation. A good cell on intermittent operation should give an output of 2.25 watts or over per cubic inch of contents, and inasmuch as the internal resistance of the cell has an important bearing upon its output, a cell of ordinary size should not have an initial internal resistance greater than .3 ohm, or, preferably, not greater than .2 ohm.

The Economic Design and Management of Telephone Exchanges—VI.

By Arthur V. Abbott, C. E.

III. DETERMINATION OF THE TELEPHONIC CENTER.

THEORETICALLY, it is easy to imagine that the various subscribers in any group could be connected to the office by air lines, and under this supposition the problem of determining the telephonic center is that of ascertaining the position of such a point, within a group of given points, as will make the sum of all the straight lines drawn from the desired point to each of the given points a minimum. If this sum be assumed to be wire mileage, it is impossible to further reduce the quantity of wire needed to reach all subscribers. The mathematical solution of this problem is possible for a few points, but when a considerable number come under consideration the necessary equations become too complicated for solution. Under all usual circumstances, it is impracticable to design subscribers' wire routes so that they shall fall along air lines drawn between the telephonic center and the premises of each of the various subscribers. On the contrary, in all towns and cities, it is necessary to follow the general highways (streets or alleys), for it is impracticable to obtain any considerable right of way in other locations. In most cases, particularly in all of the more modern cities, the majority of streets, alleys and other highways, are laid out, approximately, rectangularly with reference to each other, at least, so far as pertains to such a group of subscribers as is usually placed in a single office. For the practical solution of the problem, it is, therefore, sufficiently safe to assume that the wire routes *will* follow existing streets, and that these *are* rectangular to each other, so the problem is reduced to the location of such a point within a group of given points as will make the sum of the distances from the desired point to all the given points, measured parallel to a pre-determined set of rectangular co-ordinate axes, a minimum. Mathematically, it might be possible to select some other direction for the axes which would further minimize the necessary wire mileage; but, as it is impossible to change the arrangement of the streets, and impossible to obtain other rights of way, the only feasible solution of the problem lies in the assumption of such axes as are indicated by the direction of the streets, and it is unnecessary to consider the saving in wire mileage that could theoretically be made by the consideration of other axes.

Diagonal streets are of occasional occurrence, particularly in the older towns. The possible availability of such diagonal streets must not be lost sight of, and must be considered, as far as it is cheaper by their employment to reduce wire mileage. The solution of the problem will, however, be simplified by at first considering the determination of the telephonic center in a case with purely rectangular streets, and then afterwards ascertaining the effect which the introduction of one or more diagonal routes would have upon the previously ascertained wire mileage.

Let Fig. 2 represent the plane of any city, and let s_a , s_b , s_c . . . . . s_n represent the number and location of the various subscribers. The subscripts $a, b, c \ldots n$, denote the number of subscribers at the locations $a, b, c \ldots n$, and may be varied in value in each from 1 to n, at pleasure. The distribution of s_a , s_b , s_c . . s_n over the plane may be in any manner whatsoever. Let T be the desired point from which the sum of all lines to s_a , s_b , s_c . . . . s_n shall be a minimum, then T will by definition be the telephonic center. Let the lines $X\ T\ X^1$ and $Y\ T\ Y^1$, drawn rectangularly through T, indicate the prevailing direction of the streets or highways that are available for wire routes, so that $X\ T\ X^1$ and $Y\ T\ Y^1$ become the co-ordinate axes with origin at T, parallel to which the distances of all subscribers shall be measured; then, by hypothesis, T must be such a point as will make the sum of all the distances to all subscribers a minimum.

Symbolically, this condition is expressed as follows:

$$s_a (x_a + y_a) + s_b (x_b + y_b) + \ldots . s_n (x_n + y_n) = \text{a minimum.} \quad \text{(Eq. 3),}$$

in which x_a , x_b ..... x_n and y_a , y_b ..... y_n are the co-ordinate distances from the point T to each of the points s_a , s_b ..... s_n .

Also, let

$$s_a + s_b + \ldots . . s_n = U + V \quad \text{(Eq. 4)}$$

in which U and V are, respectively, the number of subscribers on one

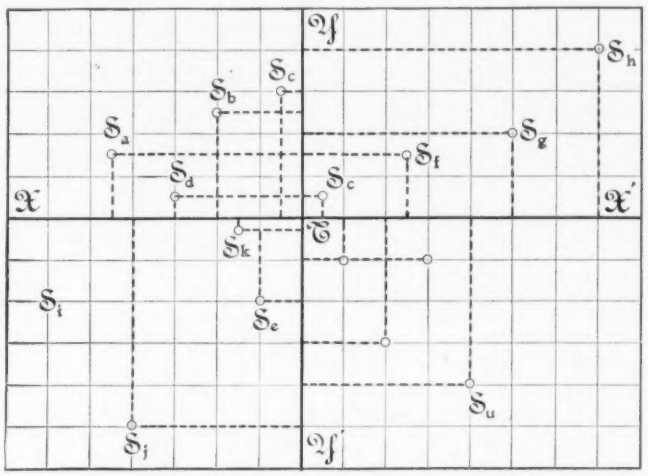


FIG. 2.—DETERMINATION OF TELEPHONIC CENTER.

side and on the other side of either of the co-ordinate axes (taken singly) through the desired point. If there be $a, b \ldots . n$ subscribers at the points s_a , s_b ..... s_n , it is legitimate to replace each term in Equation 3 by the corresponding x's and y's repeated as many times as there are units in $a, b \ldots . n$. Or, Equation 3 may be written

$$x_a + x_a + x_a + \ldots . . a \text{ times} + x_b + x_b + x_b + \ldots . . b \text{ times} + x_c + x_c + x_c + \ldots . . c \text{ times} + \ldots . . + x_n + x_n + x_n + \ldots . . n \text{ times} + y_a + y_a + y_a + \ldots . . a \text{ times} + y_b + y_b + y_b + \ldots . . b \text{ times} + y_c + y_c + y_c + \ldots . . c \text{ times} + y_n + y_n + y_n + \ldots . . n \text{ times} = \text{a minimum.} \quad \text{(Eq. 5)}$$

The following theorem will aid in obtaining the solution of Equation 5:

$$\text{Let } z = f(x, y) \qquad \text{Eq. 6,}$$

in which x and y are independent variables as in the present problem, then

$$\delta z = f(x + \delta x, y) - f(x, y) + f(x, y + \delta y) - f(x, y) \quad \text{Eq. 7.*}$$

Equation 7 is the sum of the partial differentials with respect to both x and y.

*See Edward's Calculus, pp. 112, 155.

The partial differential with respect to x is

$$f(x+dx, y) - f(x, y) = \frac{\delta z\, \delta x}{\delta x} \qquad \text{Eq. 8.}$$

and the partial differential with respect to y is

$$f(x, y\, \delta y) - f(x, y) = \frac{\delta z\, \delta y}{\delta y} \qquad \text{Eq. 9.}$$

For brevity let $\frac{\delta z}{\delta x} = M$ and $\frac{\delta z}{\delta y} = N$, then

$$\delta z = M\, \delta x + N\, \delta y. \qquad \text{Eq. 10.}$$

The symbol $\frac{\delta z}{\delta x\, \delta y}$ indicates the complete differential of z with respect to both x and y. The symbol $\frac{\delta z}{\delta x}$ indicates the partial differential of z with respect to x, and the symbol $\frac{\delta z}{\delta y}$ the partial differential of z with respect to y.

Differentiate M with respect to y obtaining,

$$\frac{\delta\, M}{\delta y} = \frac{\delta^2 z}{\delta x\, \delta y} \qquad \text{Eq. 11.}$$

and differentiate N with respect to x obtaining,

$$\frac{\delta\, N}{\delta x} = \frac{\delta^2 z}{\delta x\, \delta y} \qquad \text{Eq. 12.}$$

If any expression, such as $f(x, y)$ be differentiated first with respect to x and y, and then with respect to y and x, it is evident that the results will be equal, for the results of the same process applied to the same function must be the same, irrespective of the order in which the variables are taken, hence

$$\frac{\delta\, M}{\delta y} = \frac{d\, N}{\delta x} \qquad \text{Eq. 13.}$$

and this equation determines the condition which must exist in Eq. 10 in order that a differentiation shall be possible.[2]

To apply this theorem to the problem in hand suppose $f(x, y)$ in Eq. 6 to be the sum of the series of Eq. 5. This sum is the total wire mileage to all subscribers, which by definition must be a minimum. Let x and y (without subscripts) stand for the *average* ordinate and *average* abscissa; as U and V are the number of subscribers on each side of either axis, respectively, then $(U+V)(x+y)$ is the total wire mileage, and

$$z = f(x, y) = (U+V)(x+y) \qquad \text{Eq. 14.}$$

This expression must now be differentiated, equated to zero, and solved after the usual method applicable to problems in maxima and minima. By equations 6 to 13 it has been shown that the differentiation is possible only when the condition expressed in Eq. 13 hold true; therefore, differentiate Eq. 14 by differentiating first with respect to X and then with respect to Y, and add the two so obtained partial differentials, thus:

$$dz = \frac{\delta (U+V)(x+y)\, \delta x}{\delta x} + \frac{\delta (U+V)(x+y)\, \delta y}{\delta y} \qquad \text{Eq. 15.}$$

This expression corresponds to Eq. 10,

$\frac{\delta (U+V)(x+y)}{\delta x}$ representing M, and

$\frac{\delta (U+V)(x+y)}{\delta y}$ representing N

Now, to determine the possibility of differentiation according to the condition of Eq. 13, differentiate M with respect to y, and N with respect to x, and test for equality, thus:

$$\frac{\delta}{\delta y}\left[\frac{\delta (U+V)(x+y)}{\delta x}\right] = \frac{\delta}{\delta x}\left[\frac{\delta (U+V)(x+y)}{\delta y}\right] \qquad \text{Eq. 16.}$$

Performing the operations indicated

$$(U+V)\frac{\delta (x+y)}{\delta y\, \delta x} = (U+V)\frac{\delta (x+y)}{\delta x\, \delta y} \qquad \text{Eq. 17.}$$

[2]See Johnson's Differential Equations, p. 22.

But,

$$\frac{\delta (x+y)}{\delta y\, \delta x} = \frac{\delta (x+y)}{\delta x\, \delta y}\text{; therefore,}$$

$U+V=U+V$, Eq. 18, and it is proved that Eq. 15 *can* be differentiated. For the final solution the first differential coefficient must be placed equal to zero and the resulting equation solved, thus:

$$\frac{\delta (U+V)(x+y)}{\delta x} + \frac{\delta (U+V)(x+y)}{\delta y} = 0. \qquad \text{Eq. 19.}$$

Differentiating,

$$U+V+U+V=0 \qquad \text{Eq. 20}$$
$$2U+2V=0 \qquad \text{Eq. 21}$$
$$U=-V \qquad \text{Eq. 22}$$

There are many problems in maxima and minima, of which the solution indicates not a numerical conclusion, but a certain and very definite *condition* that must obtain in order to produce the desired result. Such is the case in the problem under consideration. U and V are the *number of subscribers* on each *side* of either one of the co-ordinate axes, and the expression $U=-V$ of Eq. 22, means *that if there are an equal number of subscribers on each side of one axis the sum of the perpendicular distances from that axis to all subscribers will be a minimum.* The same relation must obviously hold true with respect to another axis drawn at right angles to the first one. Therefore, Eq. 22 shows the *relation which the subscribers sustain to the co-ordinate axes when the sum of all their perpendicular distances to the axes is a minimum.*

In other words, if a line be drawn parallel to the prevailing direction of the streets, in such a position as to place numerically one-half the subscribers on one side of the line, and one-half on the other, the sum of the perpendicular distances from this line to all the subscribers will be less than the sum of the perpendicular distances from all the subscribers to any other line. Having thus located one axis, it is evident that the same condition will define the position of the other one to be drawn at right angles to the first, and as the telephone center must be on both axes simultaneously it must lie at the intersection of the two lines.

A New Pigment.

A patent issued Jan. 14 to Dr. Alexander S. Ramage, of Cleveland, Ohio, discloses a method of producing a remarkable iron pigment, with an old formula and new properties—the hydrated basic ferric oxide $Fe_2O_3\,Fe_2(OH)_6$. The method is in no sense electrolytic, yet possesses a particular interest for electricians, since it presents one of the first commercial applications of those physico-chemical theories which have been developed largely by the study of dilute electrolytes. In outline the process is as follows: The waste ferrous liquor derived from iron-pickling—generally ferrous sulphate or chloride with some free acid—is neutralized, and then oxidized by the joint action of air and steam. As the oxidation proceeds an alkali, as sodium carbonate in solution, is added in quantity sufficient to maintain substantial neutrality, and simultaneously therewith a large volume of water, which, as will appear, is the true precipitating agent.

The effect is that known as *hydrolysis,* or the decomposition by water of a salt composed of a base and acid between which there is a great disparity of strength, in the present instance a compound of a weak base with a strong acid. By the oxidation of the ferrous sulphate, basic ferric sulphate is formed, and this salt in the presence of the large volume of water is hydrolyzed, yielding sulphuric acid and basic ferric hydrate—the pigment in question. A reaction of this character would, of course, soon reach an equilibrium, and the yield of pigment would be but small, wherefore the gradual addition of the alkali to combine with the acid as it is liberated and to insure the continuance of the reaction to complete precipitation of the iron.

The pigment is light yellow in color, but is readily converted by heat into the several iron oxide reds, and affords also a suitable base for mixed pigments. Its absorptive capacity for oil greatly exceeds that of the standard pigments, being 2½ times that of standard French ochre, and 7½ times that of white lead. Its covering power as compared with these pigments is almost proportionately high. These figures sufficiently indicate its great technical value.

Convention of Northwestern Electrical Association.

THE Northwestern Electrical Association held its tenth annual convention at Hotel Pfister, Milwaukee, Jan. 15 and 16. The convention was called to order by the president, Mr. E. L. Debell, of Sheboygen, at 12.15 P. M., when, after some routine business was transacted, adjournment was taken until 2 P. M. The afternoon meeting was opened by an address by President Debell. After referring to the increasing prosperity of the association and the benefits it conferred on its members, he said that the work of the legislative committee for the past year has been confined to the State of Wisconsin, where very strong efforts were necessary to prevent the enactment of numerous laws adverse to electric lighting interests. These efforts have been entirely successful, and reflect much credit on the committee. He impressed upon all Wisconsin central stations the necessity of greater support and co-operation in this important work. Every company in the State, he said, should share in the necessary expense and work, and also become members of this Association, in order to insure complete co-operation and harmony. It has been necessary each year to send representatives to the State capital to defend their interests, and while the successful results hav been enjoyed by all alike the labor and expense has been borne by a few.

Secretary-Treasurer Mercein's reports, which followed the president's address, submitted the convention programme as part of the report and touched briefly on the assistance rendered the legislative committee by having all bills presented in the Legislature which were harmful to electric lighting interests, printed and sent free to all central stations in the State, accompanied by a circular urging personal influence with the senators and assemblymen to defeat the bills. Other work of the year was briefly taken up.

The following new members were elected: A. W. Grabe, superintendent Plankinton estate; C. H. Williams, superintendent electrical department Madison Gas & Electric Company; Beloit Electrical Company; George L. Smith, superintendent municipal plant, Harbor Springs, Wis.; Robert D. Crawford, superintendent electric light plant, Castleton, N. D.; Irving Butterworth, general manager Denver Consolidated Gas & Electric Company; A. P. Lathrop, president and general manager, St. Paul Gas Light Company.

Professor D. C. Jackson, as chairman of the committee on correspondence schools, reported that during the past six months he had been too busy to carry on the correspondence which he had started with the correspondence schools. As a result, however, of the action taken by the Association in appointing a committee to get the correspondence schools to revise their courses to make them more adaptable to central station men, some of the correspondence schools had greatly improved their courses. The result aimed at was, therefore, accomplished and the Association decided that it was unnecessary to continue the committee longer.

The next business was the report of ex-Governor Upham, chairman of the legislative committee. He reported five days' work put in at Madison during the last Legislature, and that all of the large number of objectionable bills that were introduced were defeated. This list of bills was of the most vicious character, and had the bills passed the electric light companies of the State would have been mostly annihilated as corporations. Mr. Kountz mentioned one bill that did go through, which was a bill to tell electric light men how to wire houses with No. 14 wire, automatic cut-outs, and a mass of other stuff in which there was no sense. The bill provided a penalty of $25, but no one could tell whom it was against, whether the company or the consumer.

The first paper presented to the convention was by O. M. Rau, of Milwaukee, on "Reconstructing and Modernizing Central Stations," an abstract of which is given below:

Mr. Rau pointed out that a proposition of the kind presented by an old plant with an assortment of varied apparatus present a difficult problem, but that a short time ago the solution would have been more difficult than now.

The recent development of the alternating current has demonstrated that for the average central station (and isolated plants might also be included), the flexibility of alternating currents leaves little to be desired, and for covering the unlimited demand that may come within the scope of a modern central station it is perfectly suited. The efficiency of all apparatus in connection with alternating currents has reached a stage of perfection where no other class of service can equal it, and its application for commercial purposes is universal, with the exception of direct charging of storage batteries, which, at present, is not a defect to be seriously considered.

To-day the solution of reconstruction problems is a relatively simple one, and has none of the questionable points to cause delay in obtaining its proper solution that confronted the manager formerly.

A single generator, covering all classes of service desired, takes the place of the former assortment, and either direct connected or direct belted solves the shafting problem. If the generator is obtained large enough so that the engine is the weaker part of the unit, in case of a heavy overload or short circuit, this excess of capacity is a valuable safeguard against its destruction.

Reconstructing a plant on these lines means abandoing all generators and installing one or two (preferably two) direct belted (in the latter case from separate engines), three-phase alternating-current generators of the four-wire type having 2000 volts potential to the fourth or neutral wire.

This generator can be used for various classes of service from the separate phases, taking, for instance, the commercial incandescent and arc lights in the business district from phase No. 1 to neutral, installing at a convenient location close to the center of load a large transformer or bank of transformers, preferably placed in a manhole underground instead of attempting to hang the enormous weight of the larger transformers on poles where they are a continual source of anxiety and danger, as well as unsightly.

These transformers are to be connected to a secondary three-wire distribution system, and if the plant was previously operated on the direct-current three-wire system, no better network could be desired to which to connect the transformer. The primary side of transformer would receive the current at approximately 2000 volts through a feeder from phase No. 1, as before stated.

The outlying commercial business would be taken care of by phase No. 2, similarly to the present method of single-phase distribution, by placing separate smaller transformers at such points as will serve the largest number of customers, or when distance becomes too great, a transformer for a customer. But in all cases the three-wire secondary should be strictly adhered to, so that as the city expands and the business district grows, each secondary network may become part of the main secondary distribution system. All service should be three-wire wherever practical, and care should be taken to keep those that are two-wire alternately on each side of the system. This will maintain as near as practical a balanced load on the transformer.

From phase No. 3 the city arc circuits through constant-current transformers can be served, and with the alternating-current series enclosed-arc lamp the highest economy as well as the most satisfactory street lighting can be obtained. These transformers can be located in the main power house, or at transformer station, centrally located in the lighting districts. In the latter case any shed, store or basement space could be utilized, as they require very little room. Or if desirable they could be placed in underground manholes similar to the transformers for the commercial circuits, although especial attention must be paid to thorough ventilation and drainage, so as to prevent trouble from the high voltage of the circuits.

The trimmer of the route centering at these transformer stations should be held responsible for this station and be required to start the lights by closing the circuit on these transformers at the proper time. This will insure reliable service and avoid any difficulties that are encountered if started from the main plant, from where they can readily be shut down by opening the primary circuit.

The expense of trimming and maintenance of the enclosed over the open arc system is very much reduced, while the usual deduction for lights out, with its disagreeable controversy with the city officials, is practically eliminated.

For the power circuits a separate three-phase feeder would be required, from which power for motors would be taken, using a group of three transformers with a Y connection on the primary side and a delta connection on secondary side, reducing the approximately 4000-volt primary to 220-volt secondary. These transformers should be located so that the three-phase secondary circuit would reach a number of power customers, as the installation of transformers for single customers becomes very expensive. By the use of three-phase motors all trouble from excessive starting currents is overcome, and motors of any capacity within the range of the generating station can be successfully operated without any material effect on the incandescent circuits.

The most important feature of this method of distribution is the absolute control of each system, and the perfect regulation which can be obtained irrespective of the unbalanced condition of the load.

The series arc system being automatically taken care of by the constant-current transformer, the three-wire power circuit is not materially affected by variable loads, while on the commercial lighting

circuits, regulating transformers giving a range of 10 per cent above or below the generator potential, can be placed in each feeder, and by means of a hand wheel constant potential can be maintained under all coditions of load.

In some instances a source of revenue is available at a considerable distance from the station. Perhaps a neighboring town, too small for an independent plant, a manufacturing plant, or some institution too far distant to be reached economically by the ordinary 1000-volt system. In this case a feeder of two wires from one of the phases is used, giving a potential of approximately 4000 volts, at which pressure the feed wire becomes a small factor, and a considerable distance can be economically reached. By using two standard 2000-volt transformers, with primaries in series and secondaries connected for standard voltage using the three-wire secondary distribution system, such business can be successfully taken care of.

In advocating the three-wire secondary distribution system many points of advantage are obtained, the most important being the availability of 220-volt current at all services. Not only is the tendency to increase the voltage of incandescent lamps little by little, but the time is not far distant when a 220-volt lamp will be as efficient as those of lower voltage, and with the supersedence of the multiple enclosed arc lamp by the Nernst lamp, the advisability of providing 220-volt secondary service cannot be questioned.

Mr. Rau stated that the object of his paper was to point out a plan of reconstructing the many smaller central stations which are operating with old, inefficient apparatus, the value of which is so rapidly depreciating that most of it can only be appraised at scrap value, the owners of which have been delayed in taking action due to the rapid change made in electrical apparatus.

In the discussion, Mr. Rau, in reply to a question by Mr. Gille, as to electrically-driven elevators, said that as to the regulation of the three-phase motor, there are a number of devices in the market accomplishing that object very economically, but a controlling device in the form of a magnetic clutch solves the problem. The motor is attached to a magnetic clutch, and as the fields of this clutch are energized it transmits the power at a variable speed to the shaft it drives. He had experimented with this device and found it very satisfactory. Mr. Gille inquired if in the case of a city where they do considerable heating and have a great many small, isolated plants running in the winter time, and during the summer time a large percentage of that business is obtainable by the central station on account of its load being very light, how it was proposed to handle that class of business. In reply, Mr. Rau said he did not believe that there is an isolated plant that can exist where there is a properly managed central station. Mr. Gille rejoined that Mr. Rau will agree with any one that an isolated plant of considerable size where they have a great deal of heating to be done, can operate in the winter cheaper than they can buy their current from a central station. Mr. Rau said that in Milwaukee they are from time to time closing down an isolated plant because his station can furnish the power cheaper than they can. There are a number of plants that have been shut down that way very recently, which have been very modern. His company is furnishing heat at the same time, which, of course, ought to be considered when a central station undertakes to do that thing. Inquired as to the matter of rates, said that the time is not very far distant when the question of a specific rate to any consumer will be a thing of the past; that, in other words, we will be obliged to have the same rate for all. It may be possible that we will be able to maintain a differential rate, such as a quantity rate, or something of that kind, but the tendency of legislation would seem to be to cut us off from even that option.

Mr. Rau said that in the case of the isolated plants he has dealt with so far, he has been able to make a kw-hour rate based on their annual consumption, and that rate is open to anybody else that can come up to it. If a plant has a consumption of $5000 worth of light a year, a certain price is made and a less price for less light. The ordinary consumer gets the regular rate, of course, but the low rate is open to any one that wants to get a great amount of current a year, and that consumer gets the same rate as his neighbor who uses the same amount. In reply to a question as to whether he would advocate changing over a direct-current underground system to an alternating-current system, where there is a large investment in storage battery, Mr. Rau said in his paper he had more in mind the smaller overhead central stations. When it comes to a large proposition, for instance, one like Milwaukee, the paper would apply. The alternating current would be generated from very large generators, and there would be direct-current sub-stations.

The question of storage battery auxiliaries coming up later in the discussion, Mr. Rau expressed the opinion that the storage battery is at present out of the reach of small central stations. For cases where it is desirable or in taking on isolated plants having storage batteries already installed he would put in a rotary converter set.

The next paper read was by Mr. Van Rensslaer Lansingh, of Chicago, entitled "Best Use of Electric Lights for Desirable Illumination," an abstract of which is as follows:

Mr. Lansingh pointed out that perhaps no engineering subject of equal importance has in this country received as little attention as the subject of illumination, especially of interiors. While the majority of buildings have perhaps sufficient candle-power per square foot, but little attention has been paid to the proper diffusion and distribution of light. Any diffusion which will save 10 per cent of a station's coal bills is greatly sought after. At the same time the light when once obtained will be so used as to waste anywhere from 20 to 70 per cent. After referring to the literature on the subject, and the importance of a steady light, absence of glare and sharp contrasts, he said that as the ideal is daylight, the units of artificial lights should in general be distributed as much as possible, at the same time placing them out of the direct line of vision. Curves and figures were given on illumination and diffusion obtained in street lighting with different kinds of globes, attention being directed to the good diffusion with the holophane globe. The diffusion obtained with various kinds of globes most common in incandescent interior lighting was then discussed.

In closing, the author called attention to the important question of keeping incandescent globes and bulbs clean. From tests made by Messrs. Legg & Townsend, of the Chicago Public Library, it was found that the increase in light after cleaning the bulbs and shades varied from 15 to 75 per cent, with an average of 28 per cent.

Wednesday morning's session was opened by the "question box" part of the programme. The first question put to the convention and the one which took the entire time assigned to that part of the programme was that of Mr. Gille, who inquired whether any of the members had had any experience with the Nernst lamp the past year in a practical way, and if so, with what results. Professor Jackson, of the University of Wisconsin, reported that they had had some of the lamps in service, and they give the most charming, soft light to be had from any artificial source of illumination. The illumination from the Nernst lamp is of almost the same quality as that on a summer day when the sky is partly covered with white clouds. No difficulty had been experienced with them in practical operation. No efficiency or life tests had been made, but he had no reason to doubt the figures of the company in regard to them. The lamps in regular operation are six of the two filament type and three of the three filament, and they have caused us no trouble. Professor Swenson has a single filament 110-volt lamp in his library at his house for a reading lamp. Those that are in use by the university in the engineering laboratories are all 220-volt lamps. In the lamps a few glower holders have been changed, but there is no difficulty about that whatever. Of the lamps that came to the university every one ran perfectly from the start, without any adjustment whatever or any examination, with the exception of one, which for some reason did not change over, and this was turned over to a wireman, who fixed it, and it has not been heard from since. Professor Jackson said he had come to the conclusion that so far as the mechanism of the lamps is concerned, they are thoroughly reliable devices; they always start all right, and the only question he has in mind at all is with respect to their life, though he has no reason to doubt the statements of the company. Replying to a question as to low-voltage lamps, Professor Jackson said that the objection he understood the company has to putting out 110-volt lamps is that they are not quite so economical as the 220-volt lamps.

In response to further questions, Professor Jackson said they had had no occasion at all to clean the porcelain of the heaters, as they did not seem to need it. He had examined them recently and they were clean. This, notwithstanding the fact that they had been desperately overrun (at over 230 volts) and each had consequently burned out a glower.

Mr. Gille said that the only serious trouble he had had was in getting all the glowers started when the lamp is turned on. If a lamp, a three-glower lamp, for instance, is put up to take the place of an arc light, and only one glower gets started, there is a pretty strong kick right off. He has not had the lamps long enough to know what the maintenance charge will be. Four or five glowers have been

burned out so far, but they tried to run the lamps at as near 220 volts as possible.

President—How many have you had in service?

Mr. Gille—Only two so far, one a single-glower and one three-glower. I would like to ask the professor if they have turned the lamps on and off very much.

In reply to a question as to the use of the lamps, Professor Jackson said they are turned on every day and turned off. They average being turned on and off a couple of times a day, with an average of an hour and a half, or two hours' burning per day. The glowers did not always come on at the same time; that is, first one glower would come on and then its heat would bring the other glower into operation.

Mr. Gille said that by jarring the lamp slightly, the glowers being seated on spring wires, they jump out of position, and that is probably the reason the glowers do not all start at once. Professor Jackson said he has noticed that the glowers that sag a little bit very often do not come on immediately, but come on after being subjected to the radiation of heat from the working glower. The fact that the illumination is so magnificently satisfactory makes a very great future for that type of lamp.

Mr. Harding said he has had one of the three-glower lamps in use something over a thousand hours, and three of the single glowers. The trouble of the glowers not starting, he has found to be due to evident carelessness in putting the glower in connection with the holder. In one case the leading wire from the glower down to the base and the plug had been sprung or bent. On the three-glower lamp that has been in use somthing over a thousand hours the glowers were changed once, but instead of changing all the glowers in the holder originally in the lamp, a new holder with the glowers complete was put in; these have been in about a hundred hours now, and the other one ran fully 900 hours without the loss of a glower. An unfavorable point is that the glower or holder becomes black, but by using a paste of some description that will scrape off readily this difficulty is overcome. He suggested sending out the holders from the central station to the customers and let them make the change, a central station man gathering up the burned-out holders at reasonable times, one man going over them to put them into shape. He has been more than pleased with the lamp. By substituting for the heavy sand-blast shade sent with the lamp a light alabaster shade a much better light was obtained for commercial use.

In reply to a question, Mr. Harding said he has furnished the customer with the lamp at the cost price, and maintains the lamp and glower free of charge, which includes the replacing of worn-out parts. There is much less expense for the unit of light than with the enclosed arc. Mr. Gille said there are some very delicate parts liable to get broken, and if the building vibrates a great deal there is liable to be trouble. He believes that when many Nernst lamps are put in it should be with the understanding that the customer should pay for the repairs. Mr. Bowen said that in using the Nernst lamp there is a decreased revenue per candle. The question is whether the central stations should furnish the means to their customers for dcreasing that revenue or increasing the light for the same revenue, which is the same thing. Gas companies do not furnish Welsbachs or other incandescent mantles. The customer furnishes these.

Mr. Almert said that in one lamp that he saw burning the cut-out hummed considerably. He asked the cause for the difference in the life of the glower in operating it on a greater or less number of cycles, the guaranty of the lamp on the life of the glower being 800 hours on 60 cycles and 1200 hours on 125.

The report of Irving P. Lord, of Waupaca, Wis., was then received as chairman of the committee appointed to consider the advisability of a summer meeting. The report was to the effect that the sentiment of the members seemed to be largely in favor of a "Summer Convention and Outing," with the two words "Convention and" in small letters, the place to be Grand View Hotel, Chain o' Lakes, Waupaca, Wis., June 25, 26 and 27, 1902. The committee recommended the wives, daughters and lady friends of the members be especially invited, and that sociability and innocent amusement be made one of the prominent features. After a lengthy discussion, it was decided to hold the summer meeting as recommended.

Elton J. King, of Fort Wayne, then read a paper entitled "Some Important Points in Commercial Measurement of Electrical Energy." An abstract of this paper will be published in a subsequent issue.

Mr. H. C. Wirt, of the General Electric Company, read a paper on the subject of "Transformers," which paper he said was the same that was read before the Ohio Electric Light Association, but on the advice of Professor Jackson he also presented it here.

In acknowledging some complimentary remarks by President Debell, Mr. H. L. Doherty brought up the subject of the National Electric Light Association, of which he is president. In certain work the National Electric Light Association is doing, the co-operation and assistance is wanted of every man interested in central station work. One purpose is to combat the growing tendency in favor of municipal ownership. In spite of the fact that statistics demonstrate beyond a doubt that the municipally-operated plants are not successfully operated, do not give the satisfaction that other plants do, either charge more for their service, or lose money, and are in all ways disadvantageous to the people of any city, over a long period of years, although for a year or so they may make a remarkable record. The National Electric Light Association has raised $2500 to be devoted to an investigation of the municipally-operated electric plants of this country. This money was raised, hoping that the League of American Municipalities would join in an attempt to investigate the true conditions of the various municipal plants. The League not accepting the proposition were informed that if they felt they could not raise the money the Association would raise the entire fund for them, but we wanted them to come in and make the investigation with us, to see that we were fair, and we would see that they were fair, and when we got that report perhaps the people would accept it, while they would not accept a report that came from either. This offer was not accepted.

Another work which the National Electric Light Association is trying to carry on is an investigation of arc lamp photometry. The work is not yet on a commercial basis, but the next report of the committee will be more satisfactory to the central station men of the country than former reports, and will give them a concrete knowledge on which to base their value of arc lighting and their value of different kinds of arc lighting. That particular work is being carried on by voluntary subscription, and Mr. Doherty suggested the subscriptions would be welcomed from anybody who feels interested in arc lamp work.

At the last session of the convention, held Thursday afternoon, the following officers were elected:

President, Irving P. Lord, of Waupaca; first vice-president, E. H. Korst, Janesville, Wis.; second vice-president, George D. Westover, Cadillac, Mich.; secretary and treasurer, Thomas R. Mercein, Milwaukee. Board of Directors: F. W. Bowen, of Kenosha; A. M. Barron, of South Bend, Ind.; E. C. Hay, Springfield, Ill.

Professor Warren S. Johnson and C. S. Fortier, of Milwaukee, gave a short talk on wireless telegraphy, in which these gentlemen have done much original work.

"A High-Power Factor System of Arc Lighting" was the subject of a short paper by W. A. Layman, of St. Louis, which described a new constant-current alternating system of arc lighting recently designed by the Wagner Electric Manufacturing Company. After viewing some of the developments that led up to the design of this system, Mr. Layman said that the system is the outgrowth of the St. Louis experiment in series lighting work. Its advantages are that the regulation is entirely automatic; the current demand from the dynamo is practically proportional to the lamps burning; the power factor is high at all loads down to a very few lamps on circuits of from 25 to 100 lamps.

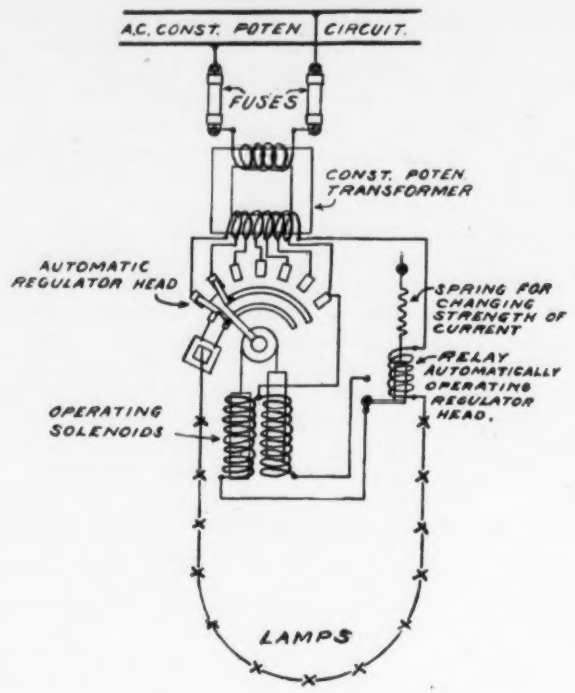
Referring to the accompanying illustration (page 162) a constant potential transformer having stationary, primary and secondary windings, and designed for high efficiency and close regulations, is employed. Such a transformer does not appreciably affect the power factor of any load applied to it. This transformer has its secondary provided with a large number of taps brought out.

An automatically operated switch has a number of steps corresponding to the taps brought out from the transformer. The mechanism of this switch is such that its lever arm is moved by an electrically actuated ratchet, either positively or negatively, so as to cut in or out portions of the secondary winding of the transformer to such extent as may be necessary to maintain for the lamp circuit a working pressure proportional to the lamps burning.

A relay in the lamp circuit is so connected as to operate the automatic switch solenoids for positive or negative rotation of the switch arm as the lamp circuit current falls below or rises above the normal required by the lamps. In the lamp circuit lamps of either the differential or shunt type are connected in series in such number as the maximum voltage of the transformer will permit. These lamps do not require an auxiliary impedance or resistance to take the place of

the arc in the circuit, and, therefore, it is possible to work the lamp circuit at the highest possible efficiency.

In response to inquiries as to the power factor and regulation of the system, Mr. Layman said that the full load power factor is 85 per cent with either kind of lamp, and that the regulation varied .2



ALTERNATING SYSTEM OF ARC LIGHTING.

ampere at the outside. The normal variation is .15 ampere. The spark at contacts is barely visible as the voltage between steps is about 100 volts. In case of short circuit the lever arm moves very quickly, and, in addition to that, an emergency choke coil is cut in by the relay.

In a paper entitled "Inspection of Hazards of Modern Plants," H. H. Hornsby, of Chicago, described a long list of examples of construction which had proved defective after a few years' use and had caused fires. A table full of relics was presented with this paper. Much of this paper, owing to the descriptive nature of the matter persented, needs the samples at hand for a clear understanding, so that its publication here would be without interest. However, the following paragraph from the paper is of such practical and universal interest to central station men at the present time, when defective transformers are proving entirely too frequent, that it is herewith quoted:

The transformer breakdown or crossing of primary and secondary coils is worthy of more than passing comment, and it should be the aim of each and every manufacturer of this particular class of device to first make absolute provision against such a condition. The grounding of the neutral wire, or the center of the secondary coil, in the event of a two-wire secondary, will undoubtedly be the means of some material protection against accident caused by the crossing of the primary and secondary coils.

At the close of the last session some time was given over to a general discussion of methods and policy. This was introduced by Mr. Doherty asking (in the interests of the programme for the next National Electric Light Association Convention) what matters the members considered of the most importance to the electrical fraternity at this time.

Mr. Gille said he thought that one of the greatest questions before electrical people to-day, and has been for a good many years, is the lightning question. A great many engineers have battled with this question a great many years, and it is still in a very primitive state, and he should like to see that question taken up and thoroughly gone into. This is especially true with respect to transmission lines all over the country.

Mr. Grier spoke of the advantage in inducing people to advertise by means of illuminated signs, which is being done in Chicago to a great extent, and in several other cities.

Replying to a request for a suggestion as to how to get more all-day business, Mr. Wirt said the single-phase alternating motor offered one solution. Many central station companies have polyphase machines, and there must be a great opportunity to install single-phase motors. Mr. Layman said he knew of a station at Whitehall, Ill., where they have a 90-kw single-phase generator, and during the daytime they operate about 45 hp of motors from that. They have one motor of 30 hp which is started with a loose pulley, and the countershaft has a good sized flywheel on it; by this means they eliminate the fluctuations in the circuit that would arise from variations of load on the motor. The motor is driving a clay-crushing plant, which is a pretty severe service. Sometimes the load in the crusher is so heavy that the driving belt slips, but the variation is not sufficient to affect the lighting that is on the machine at the same time. That same plant operates the city water system, pumping into a water tower at night. When the lighting load goes off they start a 30-hp motor, which is a mile away from the station. That motor is started, and there is a tell-tale in the water tower which indicates when the tower is filled, and then they cut the motor off at the station. In reply to a question, Mr. Layman said that the matter of the starting current of a single-phase motor can be regulated through quite a range if one cares to introduce auxiliary devices, just as would be done with the direct-current motor. The motor can be started with a succession of steps of increasing voltage, bringing the motor up without very largely increasing the current above the full load. It is good practice with all motors of large size to start them on idle pulleys, and also in small generators to put on a flywheel. Small motors are arranged to start without any auxiliary apparatus at all, and in the majority of cases there is no call for it.

In response to a question as to the progress of competition of gasoline Welsbach lights, the president said that the report which the committee on that subject presented at the summer meeting (see Electrical World and Engineer, July 6, 1901, page 16), did not show any very imminent danger of gasoline lighting taking the business. One member pointed to the very cheap rates that gas companies had made for so-called Welsbach six-burner, arc lamps. Therewith the point was made by another member that for absolute cheapness nothing could compare with kerosene oil, and that it was convenience of electric light and good service, not cheapness, that kept electric light companies in business.

Mr. Doherty said that as far as oil lighting is concerned, people will not bother with it. The nearer you can come to giving people a light where they have simply to press the button and you do the rest, the more likely are you to retain their patronage. If the business that the electric companies have lost be checked, it will be found that many of them have lost as much or more business to isolated plants than they have lost to Welsbach burners, although at one time Welsbach burners were very generally used.

People do not want to be bothered in taking care of their own lamps, and the one thing to aim at is to give customers convenient service. To-day there are not so many incandescent gas lamps proportionately as there were in 1896.

The question of isolated plant competition was brought up, especially as to whether lighting of factories that shut down at 6 P. M., was a desirable class of business. President Debell said he believes that the alternating-current station, as at present constituted, is better off without that class of business, for the very reasons that they run only until 6 o'clock P. M., or perhaps only until half-past 5, and that for only about three winter months, and just during the hours of maximum demand. Transformers and motors, etc., have to be kept on hand the year around, and, furthermore, if the shops on any one circuit are of any considerable extent, we have to either make this circuit larger to accommodate that transient trade, or else regular customers suffer from poor light during the hours, factories are using that service. While formerly quite a number of such customers were supplied in Sheboygan they have been let go. All-night customers form the most valuable kind of business that an electric station can get, whether it is a direct or alternating-current station, and his station has made extremely low rates to get all-night lighting business, while 6 o'clock lighting is allowed to go.

Mr. Harding said he has had an entirely different experience with 6 o'clock business. His town is small, and a good, big proportion of the business in lighting is for residence purposes. Taking the load curve for, say, December, the peak load is usually reached at very close to 4 o'clock; often it is much earlier than that, but taking the average for the month it would probably run 4 o'clock. Now the factories all run on sun time, which is 15 minutes ahead of standard time, and he finds that the peak load will come up long before the

hours of residence lighting, and stay there without possibly any increase on that peak during the hours that the factories begin to come off, and the time that the residences begin to come on. The factory business has thus been very profitable. If only all-night business were procured, he might not find the factory business so profitable, but in making a rate for 6 o'clock business he incidentally tumbled onto some 600 or 800 incandescent all-day lights—business that never existed before. As the station is also in the heating business, it wants the daylight lamps and not the lamps that run in the darkness, and the station has enough of the latter. In reply to a question, Mr. Harding said that about 80 per cent of his business is on meter, and all new business is on meter rates, and that the peak of his load is due to heavy factory work. There are two large woolen mills and some five or six other fair-sized factories on the circuits that take from 150 to 500 or 600 lights, and those lights are all on by 3 to 4 o'clock; very little of the residence lighting is on at that time, which accounts for the fact that the peak load remains uniform as long as it does.

President—I have in former times talked with quite a number of central station people from different localities, and, excepting in the very large cities, I had never heard before, I think, of the peak of the load coming on much before, if ever before, 5 o'clock.

He added that we should consider the total load on the electric as well as on the steam machinery, because that is what is to be provided for. The capacity for supplying these factories running up to 6 o'clock for a period of two or three months in a year has to be cared for not alone by electric machinery, but by your steam plant. Generally speaking, where a station has to maintain a considerable capacity, both in its steam and electric plant, and in the circuits on which those factories are connected, including transformers, etc., for the time that service is required by such customers—say, not to exceed three months in the year or thereabouts—such business is not profitable at the ordinary rates; and, on the other hand, the all-night customers constitute really the most valuable business that a station can get. Mr. Harding reminded the preceding speaker that he also runs a 24-hour service, which is due primarily to the heating plant, and that he has been able to connect up a factory lamp for practically every residence lamp put on the circuit, because there will be enough of the factory lights not turned on to make up the few that come on early in the residences.

The committees appointed for the coming year were as follows:

Committee on Uniformity in Advertising Pamphlets—H. J. Gille, St. Paul; F. W. Bowen, of Kenosha, and A. M. Barron.

Committee on Legislation—Mr. L. B. Livermore, Winona, Minn., chairman of the committee. The first of the following names from each State will be the chairman of the committee in that State:

Mr. C. E. Hay, Springfield, Ill.; Mr. W. H. Schott, Chicago; Mr. E. P. Maxwell, Dixon. For Michigan—W. Worth Bean, St. Joseph; W. F. Kingan, Sault Ste. Marie; E. D. Daniell, Menominee. For Wisconsin—Mr. H. C. Higgins, Marinette; Mr. T. F. Grover, Fond du Lac, and Mr. C. H. Williams, Madison. For Minnesota—Mr. S. B. Livermore, Winona; Mr. H. J. Gille, St. Paul; Mr. G. D. Shepardson, Minneapolis. For Indiana—Mr. J. H. Harding, Laporte; Mr. A. M. Barron, South Bend, and Mr. H. W. Frund, Vincennes. For Iowa—The manager of the Cedar Rapids Electric Light & Power Company, of Cedar Rapids; Mr. C. C. Hammond, of Mason City, and the manager of the Eagle Grove Electric Company, of Eagle Grove.

The following central station men in attendance at the convention: Irving P. Lord, Waupaca, Wis.; E. L. Debell, Sheboygan, Wis.; H. J. Gille, St. Paul, Minn.; P. H. Korst, Janesville, Wis.; W. H. Schott, Chicago, and Bloomington, Ind.; A. M. Barron, Franklin, Ind.; C. H. Williams, Madison, Wis.; W. W. Rod, Appleton, Wis.; W. H. Upham, Marshfield, Wis.; A. J. Hamacek, Sturgeon Bay, Wis.; W. J. Greene, Cedar Rapids, Iowa; C. F. Freehauf, Cresco, Iowa; R. Trumball, Kenosha, Wis.; H. F. Pearce, Negaunee, Mich.; George L. Smith, Harbor Springs, Wis.; George H. Kuelthan, West Bend, Wis.; J. S. Allen, Beloit, Wis.; O. M. Rau, Milwaukee; H. C. Higgins, Marinette, Wis.; W. F. Collins, Wausaw, Wis.; M. Weeks, Wausaw, Wis.; G. E. York, Portage, Wis.; F. G. Rodolph, Mascoda, Wis.; G. H. Strang, Richland, Wis.; W. P. Bragg, Monroe, Wis.; F. W. Bowen, Kenosha, Wis.; Irvin Butterworth, Denver, Colo.; A. P. Lathrop, St. Paul; O. B. Williams, Whitewater, Wis.; H. L. Dougherty, Denver, Colo.; T. P. Carrier, Edgerton, Wis.; Sinclair Mainland, Green Bay, Wis.; George B. Wheeler, Eau Claire, Wis.; M. E. Malone, Madison, Wis.; J. H. Harding, Laporte, Ind.; A. Kuhlman, Elkhart, Ind.; Bradford D. Viles, Chippewa Falls, Wis.

The Question of Safety in Electric Traction.

The public and technical interest in the announcement last week of the intention of the New York Central Railroad to adopt electric traction for the Park Avenue tunnel where the collision occurred recently was greatly stimulated by the immediate subsequent appearance in the *New York Times* of a letter from Mr. George Westinghouse, which, owing to its construction, was at once taken by that journal and evidently by a great many of its readers as a warning against the use of electricity for such places and under such conditions; and was, therefore, resented with much sharpness and surprise, in view of the quarter from which it came. That a great electrical manufacturer should discredit electricity seemed unbelievable, and in a second letter Mr. Westinghouse endeavored to make his views and his attitude clear, namely, that he is advocating such plans as will prevent the cars from burning up, should an accident happen, and such methods as will reduce to a minimum the chance of an accident. It is impossible for us to find space for all the matter born of the controversy thus aroused, but as will be seen we give the two Westinghouse letters, and that of Mr. Frank J. Sprague.

Mr. Westinghouse's first letter, of Jan. 11, runs as follows:

It may prove useful at this moment to direct the attention of the press to certain features incident to the use of electricity for the operation of trains or cars.

From the comments which have already been made in regard to the accident which is now uppermost in our minds, it seems to be assumed that such accident would in all probability not have occurred if the colliding trains had been propelled by electricity, and also that the absence of steam would have lessened the risk to the occupants of the telescoped cars.

As a matter of fact, with an electrically-operated train the risk of accident will, judging by experience, be increased rather than diminished because of the presence of the heavy electrical machinery which it is proposed to attach to several cars of each train. Already there have been many serious collisions with great loss of life between electric cars, while there have been numerous cases in New York and other places in which cars have been quickly destroyed by fires which have resulted from some derangement of the electrical apparatus or circuits, and in some instances so quickly that passengers have had scarcely time to escape to the street.

It should be borne in mind that the electric energy required to operate a heavy train is sufficient to melt a considerable bar of iron, or to start a dangerous fire, if anything goes wrong upon a car of ordinary combustible construction, much more readily than the car stove, the use of which has been abolished by law. Therefore, if a collision were to occur between two electrically-fitted trains, each having several combustible cars thereof fitted with electrical apparatus and carrying electrical circuits throughout, there could be an accident of so serious a character as to start an agitation having for its purpose the abolition of the use of electricity altogether, or at least to compel the railway companies to abandon the use of combustible cars fitted with electric motors.

The destruction by fire of a car or train upon a street or upon a level is one thing, but such an occurrence upon an elevated railway or in a tunnel can have consequences the contemplation of which should lead to wise regulations governing the construction and use of electrically-propelled trains and thereby insure to the public the rapid development of electric traction.

In Liverpool, during the past month, an electric train, while running in a short tunnel, was set on fire by the electric current and totally destroyed, with considerable loss of life.

Upon this Mr. Sprague offered the subjoined comment:

Your editorial in yesterday's issue, deservedly rebuking Mr. Westinghouse for his pessimistic and ill-advised letter, is in error in stating that it will be read with consternation, or even with surprise, by electrical engineers, notwithstanding Mr. Prout's indorsement.

Mr. Westinghouse has a habit, which I fear is almost chronic, of tendering advice to those contemplating advanced methods in electrical transportation, to do nothing unless it be to wait until his particular plans have materialized. Because of his prominence and much good work in the engineering world, over-much importance may be attached to his dictum on electrical subjects, in the advanced arts of which Mr. Westinghouse, however, is less apt a student and less qualified a judge than he is in the matter of air brakes.

An unhappy accident in the New York Central tunnel has, because of its appalling consequences, appealed most strongly to popular feel-

ing and prejudice. It is not my present purpose to discuss the causes of this accident, to try the apportionment of blame, or to point out what I may think are the proper remedies, but Mr. Westinghouse's comments are properly subjects for criticism and correction.

His letter is dated Jan. 11, some four days before the apparently premature announcement of tentative plans, which, it is reasonable to assume, have for some time been and still are under serious consideration by the railway company.

I have, in common with many others, definite ideas as to what may be accomplished for the betterment of the existing state of things, formulated with knowledge of many well recognized responsibilities and difficulties. Appreciation of the serious character of any problem is not, however, excuse for shirking its solution, nor sufficient warrant for men whose word may be given undue weight committing themselves to unwise alarmist comments, which may act to delay needed improvements.

Although the official announcement of the company's plans, as far as described, details no specific method of electrical operation, Mr. Westinghouse assumes that it is proposed to move all trains by motors attached to "several cars of each train." The plan thus indefinitely referred to is what is now known as the "multiple unit system," was first introduced by me on the South Side Elevated of Chicago, four years ago, and is now the generally accepted method of train operation for certain classes of service. It is a method of train control and operation by means of which locomotives or cars, each equipped with motors and controllers individual to these motors, can be aggregated at will, with or without other cars unequipped with motors, into train combinations of any length, and controllable from any desired point.

The system has found in Mr. Westinghouse a persistent opponent, although obliged by the advance of transportation methods to yield it some measure of approval, and he takes the present opportunity to first assume what the railway company itself is not yet ready to announce, and then condemn its possible adoption by criticisms based on false premises, and supported by misleading statements. That the multiple unit system, already indorsed by 300,000 hp of equipment within four years, is an essential in any general solution of many railway problems of to-day, goes without saying, but it is equally certain that modified or alternative plans must be applied to other problems.

Mr. Westinghouse declares that already there have been many serious collisions on electric cars, with great loss of life. It would have been more to the point if he had explained that almost invariably these have been with single cars on single-track roads, where no adequate signals were in operation, or where they were ignored. Where there have been collisions between trains on electrically-operated elevated roads, the cause has been fog and absence or disregard of signals, and the loss of life has been a minimum. In no case has such a collision caused a conflagration; this last, when it has occurred, having been on account of defective work. There is less reason why fires should occur on well-equipped multiple unit operated trains than on single cars in the streets, for it is undeniably true that much greater care has, at least in some cases, been exercised to create fire-and-fool-proof apparatus.

The statement is also gravely advanced that the amount of current necessary to operate a train would melt a large bar of iron. So, too, would the amount of current necessary to light an ordinary building, but an essential of the multiple unit system is the localization on any motor car of controlling apparatus individual to its motors, and limited in current to their capacity. No controlling device in this system carries the entire current of the train; heavy currents are especially prohibited being carried from one car to another, and the controlling currents are less than those in an ordinary lamp circuit.

Ignorance and carelessness of motormen is largely discounted, in that the current in-put in each motor equipment is, where the system is properly installed, automaticaly limited to absolutely safe amounts. Where derangement of a circuit occurs, causing an abnormal increase of current, safety devices of reliable character provide against its continuance.

Mr. Westinghouse makes reference to an accident, the first of its kind on that road, although in operation for 11 years, which recently occurred on the tunnel section of the Liverpool Overhead Railway. This equipment had the very objection which the multiple unit system was designed to avoid, in that main currents were carried from the regulating apparatus at the head of the train to motors at the rear end. Whatever the actual cause of trouble, the presence of creosoted wood in the tunnel largely contributed to the serious character of the disaster.

Evidently Mr. Westinghouse is apprehensive that the multiple unit system may be found advantageous in some proposed equipment on the New York Central, but it is safe to assume that any well-matured plans will not be stopped because of objection from a manifestly interested source, and that if it be satisfactorily demonstrated to the railway company that electrical operation will prove advantageous, it will be adopted, whatever the system or cost.

Mr. George H. Benjamin came out in the *Evening Post* and "indorsed Mr. Westinghouse in every particular." He would, he said, go further and say that the problem which now confronts the New York Central could not be solved by the aid of electricity, at any rate, not by electrical devices of the present day. It will be seen from the following second letter of Mr. Westinghouse that Mr. Benjamin misunderstood him seriously. The letter is as follows:

Permit me to thank you for the prominence you have given to my letter of the 11th and the discussions thereon. Your editorial of to-day invites more discussion of this subject, and possibly further criticism in the line of the unexpected interpretation of my letter. The controlling paragraph of my letter, to which I again invite your attention and that of railway managers who have the first responsibility to the public and of electrical engineers, is as follows:

"The destruction by fire of a car or train upon a street or upon a level is one thing, but such an occurrence upon an elevated railway or in a tunnel can have consequences the contemplation of which should lead to wise regulations governing the construction and use of electrically-propelled trains and thereby insure to the public the rapid development of electric traction."

From questions which have been asked, it is evident that the word "combustible," which obviously should be read into this from the preceding paragraph, has been quite overlooked.

No one can have a stronger belief than I entertain of the advantages to be derived from the use of electricity in the operation of trains. A lifelong experience, however, in connection with safety appliances upon railways has caused me to view the subject from quite a different standpoint from that usually taken, especially by inventors and promoters, and in some cases by manufacturers of electrical apparatus, who evidently dislike to emphasize the dangers attending the application of so much electrical machinery beneath the ordinary combustible cars now generally in use and the utilization of which has been contemplated in order to keep down the total cost of installation.

I believe a further useful purpose will be served by particularizing some of the dangers to be guarded against in the fitting of trains with electrical apparatus:

1. A great advantage of electric traction is the possibility of a much higher speed. This, however, while not extending the vision of the engineer in charge of the apparatus, will require a greater distance within which to stop the train.

2. When many tons of electrical apparatus are distributed beneath several cars of a train, and of necessity more or less loosely supported, and between which and the rails and roadbed there is but a small clearance, it is evident that much greater precautions will have to be taken than is ordinarily the case with the running gear of the present steam cars, derangements in which have often been the cause of accident.

3. Electrical apparatus supported beneath the car can develop by means of a short circuit heat energy sufficient to instantly ignite cars of wood construction, and this has occurred repeatedly, notwithstanding the presence of safety appliances intended to guard against such occurrences.

4. When a total wreck results from an accident, and experience has shown that accidents are inevitable whatever the mode of propulsion, the debris scattered over the "live" and other rails would render useless the ordinary circuit controlling devices which may be located upon the cars. This emphasizes the importance of a non-combustible construction of cars.

The public announcement that Mr. Yerkes, who has had so many years of experience in matters of this kind, proposes to construct his cars for the underground railways in London of non-combustible material, is a corroboration of the views I sought to bring to the attention of the public through your columns.

I am not disturbed by personal criticisms based upon a misappre-

hension of my motives, which are entirely in the interest of the public and not in the slightest degree governed by my personal interests. It may be to my credit to render a public service.

On the same page with this was a letter from Mr. Benjamin asserting that electricity "is not only unsafe but impracticable." Mr. Harry Alexander also had a letter in the same issue, taking up the cudgels warmly for electricity and the multiple unit system.

Important Arguments on Taxing Franchises.

At Albany, on January 12, important arguments on the franchise tax in New York State, were delivered before ex-Judge Earl by Frank Platt, Professor Charles A. Collin, William N. Dykman, Henry Hemmens, John C. Tomlinson and W. H. Page, Jr.

Mr. Platt was the first speaker, and argued that the Legislature had imposed an impossible task in directing special franchises to be valued as real estate. He did not deny that the power existed in the Legislature to lay a franchise tax upon a "public franchise," but he held that in imposing such a tax the method of arriving at the amount must be prescribed. He contended that there is no method by which the value of a right to use streets can be ascertained, and that when the Legislature attempted to levy a property tax on special franchises, and directed the assessing officers to value such rights as real estate, such direction could not be carried out. In support of that proposition, Mr. Platt directed attention to the statute's definition of a special franchise. It is a right to use the streets and the tangible property connected with that use. The State having conceded that the tangible property is to be valued according to the cost of reproduction, the dispute is only as to the valuation of the right to use the streets. This right, he said, must, if it can be assessed at all, be assessed at its intrinsic value, as property, and not according to the extent to which it may have been used by its owner, nor according to the earnings or profits which its owner may have made from its use in his business. Unlimited rights may be granted, for example, to two gas companies to lay pipes in all of the streets of a city, and each may use its right only partly. If each company is taxed according to the extent of use of its franchise, the tax is then laid upon the pipes and not upon the franchise granted. One of these companies may by establishing relations with more customers, or by better economy, make more profits than the other, but to assess these franchises according to the respective profits would be to tax management and good-will, not franchises.

Professor Charles A. Collin, who followed Mr. Platt, for the Brooklyn Rapid Transit system, elaborated, with great detail, the alleged Federal unconstitutionality of the Ford act. He made four points, any one of which, he said, was fatal to the assessment. In the first place, it impaired the obligation of the contract between the company and the city or State. Again, the absence of any standard of a valuation in the statute itself made the operations of the State Board mere guesswork. The taking of property on any such basis for taxation, or otherwise, was, the Professor explained, the taking of property without due process of law, and, therefore, unconstitutional. He explained that if the property were not real estate, it contravened the fourteenth amendment of the United States Constitution. The personal property of all citizens is taxed only after the debts of the owner have been deducted therefrom. The special franchises are treated as real property. The special franchises of the relator are not allowed this deduction; consequently, if they are personal property, an unlawful discrimination is provided, and the scheme of the Constitution, giving equal protection of the law to its citizens, falls to the ground.

Dealing particularly with the street surface railways of Brooklyn. Mr. Collin showed that the charter of Brooklyn, for many years, had contained a provision that the licenses paid by street railway companies to the city were to be deemed in full compensation for the use of streets. It was in acceptance of the public offer of the city, authorized by the Legislature, that the elaborate Brooklyn Rapid Transit system had been built up. The inducement to the company was that if it acquired a franchise, except in so far as it might voluntarily submit to further conditions, the only additional taxation which could be imposed upon it for the privilege of operating its cars in streets was to pay the city a specified sum per car. If this sum were to be increased, as the Ford franchise act contemplated, then the contract created by the company's acceptance of the city's proposition to give it improved transit facilities on the basis of existing law amounted to nothing.

The power of the Legislature to violate, or authorize the violation of any such contractual relation, Mr. Collin explained, contravened the decisions of the courts of the United States from beginning to end. These rights of the company had been interpreted judicially by the Court of Appeals in the case of People vs. O'Brien, and the law of that case had been adopted and applied in all other States of the United States where similar questions had arisen, and it applied conclusively to the cases now before the referee.

W. N. Dykman, representing the Coney Island Railroad and Flatbush Gas companies, who was the next speaker, showed that the special franchise tax tracks of the Coney Island & Brooklyn Railroad begin a block from the Brooklyn Bridge and ends at Prospect Park, but under contracts with the Brooklyn City & Newtown Railroad the Brooklyn City Railroad and the City of New York, the route of the railroad had been extended to Park Row, Manhattan. No one, he argued, could determine how much of the income comes from the special franchise tracks and how much from the Bridge and the tracks of other railroads. In speaking for the Flatbush Gas Company he said the gas franchise and the electric light franchise were granted at different times and to different companies, the electric light franchise having been purchased from the Knickerbocker Electric Light Company. Yet the State Board of Tax Commissioners assessed and valued these two utterly dissimilar and competing special franchises as one, which he contended was illegal.

Henry J. Hemmens, of counsel for the Consolidated Telegraph & Electrical Subway Company and the consolidated New York Edison Company, contended that the unconstitutionality of the special franchise act was illustrated particularly in the case of the companies he represented, by reason of the fact that the franchises which the companies had acquired were first secured by agreement with the city, and the terms of this agreement were then ratified by the Legislature.

John C. Tomlinson, on behalf of the New Amsterdam Gas and other companies, said in part that there seems to be a public impression that the corporate reorganizations and their large capitalization which have taken place in the last few years had been due to the value of the franchises possessed by those corporations, and such legislation as the special franchise tax act in question is directed to the taxation of those franchises, upon the theory that they are of great and growing value. In point of fact, however, the incentive to the great corporate reorganizations has been the chance of profit which would inure to the parties in interest by the introduction of more efficient management and more economical methods; and what has been capitalized and what has given the value to that capitalization has been the increased earnings which better management could and has secured. In point of fact, it is impossible either for the tax officers or the court reviewing their action to value the corporations' right to lay, maintain and operate its pipes in the streets.

William H. Page said that admitting the act of 1899 to be constitutional and possible of administration, it must be applied so that each separate franchise of the Metropolitan system was assessed for its sole and particular value. To show these values, he took the testimony of President Vreeland, that "if all the properties controlled by lease by the Metropolitan system were taken by their owners, leaving only the Metropolitan system, there is not a single line in the Metropolitan system that would pay its operating expenses." Mr. Page referred to the statistics in the case, proving this statement and proving that the earning power of the company, which the Commissioners admitted they had taxed, was produced by the economies in management and operation. He pointed out that the Commissioners had admitted also that they had made their valuation on the earning power of the company derived from its ability to carry the passenger over the whole of its route, and yet the law told them to value only the four franchises that the company owned, and not at all the three franchises which it leased, the value of which was assessed against the other companies owning them. President Roosevelt, Mr. Page said, in conclusion, in his recent message to Congress frankly recognizes the position taken by the plaintiff companies in this litigation when he stated that "the slightest study of business conditions will satisfy any one capable of forming a judgment that the personal equation is the most important factor in a business operation; that the business ability of the man at the head of any business concern, big or little, is usually the factor which fixes the gulf between striking success and hopeless failure."

Trolleys in the English Midland Counties.

Mr. S. C. McFarland, United States Consul at Nottingham, England, has made a very interesting report to the State Department on the trolley systems and plans of the Midland Counties. In the course of it he says:

The development of electric railways in the midlands has been, from an English point of view, phenomenally rapid. When, in recent reports I prophesied a quick growth to a scope of operations not then contemplated, the idea must have seemed optimistic to American electricians having experience with English methods; but more than partial realization of those prophesies seems imminent. The Nottingham corporation is just completing the fourth section of its city system, and is applying to Parliament for other extensions, demanded by a public which a year ago scoffed at the general idea, but which has, through the operation of the lines already established, received a quick and practical education. These proposed extensions are all within the corporate limits, and by action of the City Council this week the costs have been cut below the original proposals, because of the financial condition of the city, which is heavily in debt, owing to the many enterprises undertaken by it within recent years under the policy of municipal ownership, the last statement placing the indebtedness at about $23,500,000. But while the city appears to have reached a present limit, private capital is now prepared to undertake a very large system of suburban and interurban traffic, to be operated in connection with the local systems in the several larger towns involved; and for several of these schemes, which are outlined below, parliamentary powers are being requested. The two principal plans are promoted by Sir James Kenneth Douglas McKenzie, and by Sir Bache Cunard, and the first embraces a large portion of the county of Notts and part of Derbyshire, while the latter relates mainly to establishing a connection of light railways between Nottingham and Derby. If the application is granted, something like a revolution will take place in means of communication between large rural districts and the principal centers of population. The scheme of McKenzie will connect Mansfield with Alfreton, Ripley, Belper and Ilkeston, and Ilkeston with Nottingham, and also throw out another line between Nottingham and Derby, passing through Beeston and Long Eaton, and giving a connection from a suitable point between Ilkeston and the Derby route. There is further a proposal to carry a line to Arnold; also to Carlton, and eventually to Burton Joyce. By a third proposal, Hucknall Torkard is to be connected with Bulwell. The scheme embraces a distance of about 70 miles, including the section at Mansfield covering 12 miles, which has already been sanctioned; and the total population to be served approaches 500,000.

One matter in connection with the McKenzie scheme possesses an educative interest. It is proposed to inaugurate a service of workmen's cars from one town to another over the whole system. These, of course, would have to be run at cheap rates, and the suggestion is that half—or less—of the ordinary fares would be charged—say, 1d. (2 cents) for four miles.

At present the means of supplying current for the working of the railways does not exist, but this will not present any difficulty. The promoters are willing, where local authorities generate their own current, to make terms with those bodies to supply what is required, but failing that, it is likely that arrangements will be made with the proposed Derbyshire & Nottingham Power Company. This company, it may be added, already proposes to establish generating stations at Ilkeston, Colwick, Trowell and Warsop.

As to the carrying out of the works, the general engineering of Sir Douglas McKenzie's scheme will be under the control of Mr. John Fell, a well-known tramway expert. The work, as already indicated, is divided into two sections. That which embraces the southern portion, including the lines which touch Nottingham, is in the hands of Mr. C. H. Gadsby, of Westminster, who has carried out many important railway works; while the northern section has been intrusted to the Birmingham firm of engineers (Messrs. A. Dickinson & Co.), who have done a good deal of work of this character in this country, and have carried out many large schemes in Spain, Cape Colony, etc.

Altogether, this proposed linking of city with private enterprise, thus suddenly covering a large territory in the conservative midlands with a network of modern electric lines, is an astounding development for England. The scheme, however, is only the forerunner of what will follow elsewhere in the provinces, as well as in London. The effect of this electrical development upon existing rail way lines, whose earnings are already at the maximum and whose dividends are yearly decreasing, will soon present a serious question.

Hearings on the Commercial Pacific Cable.

Last week we made note of the hearings on the Pacific cable before Congress, up to the time of our going to press. The hearings were carried on later and a special telegram from Washington, of Jan. 17, says: The advantages of government control of the projected Pacific cable were presented to-day before the Commerce Committee of the House. Admiral Bradford, who has had charge of the cable soundings; General Greely, head of the United States Signal Service; Captain Russel, who has done much of the cable work in the Philippines, and Mr. Thomas F. Clark, vice-president of the Western Union Telegraph Company, were among those present. Mr. Clark said the plan presented by the Commercial Cable Company contemplated exclusive arrangements with the lines in the Far East, the effect of which would restrict the business to this one line, preventing competition and such advantages to the Government and public as would accrue from competition. He emphasized the prospective commercial development of the Orient and likewise the disadvantage that would accrue from private control, which would tie up the business for an indefinite period and place the Far Eastern links of the cable system entirely under foreign control.

General Greely stated that about 10,000 miles of cable and telegraph were now under Government charge. He favored Government control of the Pacific project, and showed the extent to which governments were extending their control of cables. One of the recent extensions was by Germany on the China coast, while France and other countries were making similar cable extensions. General Greely said an American cable to the Philippines would do much good in the Americanizing of the islands. He cited instances of the current Philippine news that was reaching the islands by foreign cables, presenting the affairs of Germany and other countries, but not mentioning the most important developments in the United States. During the Spanish-American war, said the General, it became necessary for him to secure control of the Haitian cable for 30 days at $2,000 a day. In time of war, he explained, it was impossible to observe due secrecy when cable lines were under foreign control. He had discussed the subject with President McKinley, who was favorable to an "American cable under American control, in peace and war."

Admiral Bradford was favorable to having the cable laid, operated and controlled by the Government, not for commercial considerations, but as a naval and military necessity. He said the British Navy had great advantages over other navies by reason of being linked by cable with all insular possessions. If there were a war with Great Britain to-morrow, he said, it would be impossible for us to communicate by cable with the Philippines. The Navy Department had made all soundings, said the Admiral, and had found a practicable route, which was all ready for the Government to begin operations. It started from Monterey, Calif., which he considered a better point than San Francisco. He did not recommend a cable of American make, as the industry was not developed here, and it was essential to get the best the world produced.

It would appear that hearings before the Senate and House committees on the Pacific cable question have developed two widely divergent lines, between which the Government will have to choose if cable legislation is to be a part of the programme for the present session of Congress.

From present indications the sentiment in the House is favorable to Government ownership. On the other hand, some of the most prominent members of the Senate, both in the majority and minority, declare against Government ownership. They say that a private corporation can purchase material and fill contracts cheaper than the Government. Opinion in the Senate seems to be shaping itself in favor of Senator Hale's position that the laying of the cable should be encouraged and permitted by a private corporation with the provision that after a stated period the property shall be obtained through purchase by the United States without further formality than its appraisement.

Senator Hale, who will be a controlling factor in legislation relative to the cable because of his position as chairman of the Naval Affairs Committee, insists upon definite provisions being included in any cable legislation obtaining reasonable and equitable rates to the

public and nominal rates to the Government. The company which is seeking with such energy to obtain the rights from Congress to construct the cable has indicated that it will build a cable under these conditions.

Dr. Perrine Before the New York Electrical Society.

The combination of science and audacity which characterizes much of the long distance transmission work done during the last few years in California was strikingly brought out at the well-attended 220th meeting of the New York Electrical Society—held Jan. 15—by Dr. F. A. C. Perrine, who lectured on "The Power Plants of the Pacific Coast." Dr. Perrine said that one of the objects of his lecture was to show the men in the East that the far Westerners were no mere rough-and-tumble engineers, and it was generally admitted that this point was abundantly proved. A more wonderful series of pictures of brilliant engineering feats than that thrown on the screen by Dr. Perrine has seldom been presented to a scientific audience. Dr. Perrine's work has been such as to make him a recognized authority on the subject of long-distance electrical transmission. As consulting engineer he had much to do with the pioneer work of the great Standard Company, and he is now president of the Stanley Electric Manufacturing Company, of Pittsfield, Mass., the designing engineers and manufacturers of the electrical apparatus used in the standard plants.

During the discussion, Mr. T. C. Martin suggested that the present week was one which would be notable in the history of the American Institute of Electrical Engineers and the New York Electrical Society, inasmuch as on one of its evenings the Institute learned the details of the achievement seen in the transmission of a wireless signal across the Atlantic, from the lips of the man who had done it, and on another evening the Society listened to a description of the longest power transmission in the world, that from Colgate to San Francisco, 215 miles long, by one who had taken a most active part in the work.

Dr. Perrine's paper, which was most entertaining as well as being of notable technical value, is to be published by the Society, by which it was greatly enjoyed.

New Telephone Patents.

Four telephone patents emerge from the issue of Jan. 14, three relating to party-line systems and the fourth to no system at all—since it is a device for converting a metallic circuit into a grounded circuit in the event of the two wires of the metallic circuit becoming crossed or one of them being grounded or broken.

Mr. Isidor Kitsee, of Philadelphia, is the inventor of a party-line system of the step-by-step contact maker and three-line-wire family. Mr. Kitsee, in his specification, disclaims the three-wire impeachment, and points out that his third wire is only required to double back from the last station on the line to the first. In illustration of what a simple matter this is, he supposed a party line carried five miles from the central office with all the sub-stations in one block or house at the end of the line; the third wire would then, of course, be required only in that convenient block or house containing all the sub-stations. Most party lines, however, are not built that way. In practice, the third wire would entail a three-wire line for the greater part of the party-line circuit. In his system Mr. Kitsee sets out to provide an arrangement by which when one station calls the central office, or when a station is called by the central office all the other stations are locked out and can neither call nor listen in; further, the central office can selectively signal each station, and, if a station wants another on the same party line can throw a shunt around the lockout device and so enable the called station to connect with the line.

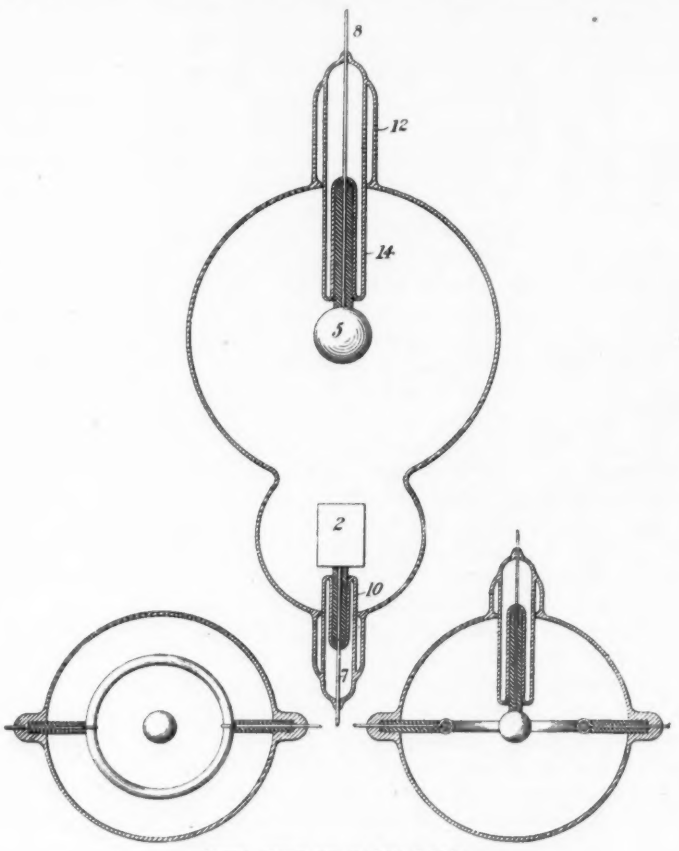
Mr. Frank E. Mayberry, of Medford, Mass., patents and assigns five-eighths to two gentlemen residing as far apart as Hoosick Falls, N. Y., and Chicago, Ill., a party-line system which in all respects fairly earns the record for complications. Eleven pages of specifications and claims and six sheets of the most complicated drawings to set forth this device, while no fewer than 49 paragraphs of claims are needed to protect the product of Mr. Mayberry's ingenuity. To attempt to do justice to such an invention in a mere abstract is to attempt the impossible, and the most painstaking investigator is driven to the verge of nervous prostration by drawings in which all wires and connections are shown in meandering lines with innumerable irritating spurs that remind one of the rivers and railways on a very small scale map. Mr. Mayberry's invention purports to supply a system by which any station on a party line can call the central office and lock out all the other stations, and reciprocally the central office can selectively signal and connect any station on the line and lock out all the others. A step-by-step selector and various other electrical and mechanical devices are required at each station to effect the purposes of the invention. Only one pair of line wires is used for both signaling and telephone apparatus, but the complication of the apparatus at each sub-station is so great that it is open to doubt whether the system could ever give satisfactory service in the hands of the ordinary user.

Messrs. Albert K. Andrians and Hermann Herbstritt, of San Francisco, patent and assign to the Automatic Interconnecting Telephone Company, of the same place, an individual telephone switch and lockout mechanism for interconnecting lines. This device is to enable any station on a party line to call up any other station on the line without the intervention of a central office, and to lock out of circuit all the stations but the one called. This is another complicated selective device involving separate circuits for signaling and for talking; and while it may be adapted to a purely interior system its scope would appear to be practically limited to that narrow field.

Mr. Walter K. Cook, of Mason City, Iowa, patents a "telephone circuit" which consists of an arrangement of switches and connections for the purpose of converting a metallic into a grounded circuit in the event of the two wires of the metallic circuit becoming crossed, or one of them being grounded or broken, the other remaining intact. As an impracticable idea, this caps the climax.

New Type of Vapor Lamp.

Two patents were issued last week to Peter Cooper Hewitt on a vapor lamp which differs considerably in detail from the type of lamp with which the name of the same inventor has heretofore been associated. Referring to the accompanying illustrations it will be seen that the lamp is of much smaller dimensions than the former lamps of the same inventor, approximating more nearly to the size



NEW TYPE OF VAPOR LAMP.

of the ordinary incandescent lamp. The main feature of the lamp is the use of a cathode consisting of a light-emitting material, such as one of the rare earths, or mixtures thereof.

Referring to the upper figure of the accompanying illustration, 2

represents the anode and 5 the cathode. The anode is seated within the glass column 10, which surrounds the leading-in wire 7. The cathode is seated in the tube 14 of porcelain or other suitable material, which is a non-conductor, and which retains this property when hot, and is inert to electrical or chemical actions at the temperature to which it is subjected in the lamp. The cylinder 14 is carried by a stem or column 12 of glass, through which the leading-in wire 8 passes. The joints between the electrode and the porcelain and between the porcelain and glass are sufficiently tight to prevent the electric current from passing through them and reaching the metal parts within, thus forming an electrically-tight insulation over the leading-in conductor.

As stated before, the material of the cathode consists of one or more of the rare earths. The high resistance of this material when cold is not objectionable, since there will be sufficient electric leakage into the lamp from the conductor leading into it, to start the current, and when the current is started it will heat the material by reason of its position at the negative electrode. In normal operation the cathode will be heated to a very high temperature, becoming thus a light-emitting body. Gas of the proper density is placed within the globe, and when the current traverses the lamp considerable heat is generated at the cathode, and the surrounding gas being in a measure a non-conductor of heat, the temperature cathode is maintained sufficiently high to be light-emissive.

The inventor states that with attenuated nitrogen contained within the chamber and with iron electrodes separated a distance of about 1½ inches, the lamp may be started with a direct current having a pressure of 750 volts or less; and the resistance which the gas offers to the passage of the current and the resistance which is offered between the gas and the cathode will render the lamp self-governing and pass a definite amount of electrical energy and convert it into light and heat, the heat being sufficient to maintain the cathode in a state of incandescence. It has been found that the resistance of a vapor varies inversely with the current; but with this lamp, in the case of an increase of current the consequent reduction of resistance in the vapor-path is compensated for by an increased resistance at the cathode, and vice versa. This particular form of resistance is a phenomenon that takes place under proper adjustment when there is no chemical or physical action at the negative electrode.

The feature of self-regulation is important whether the lamp be constructed to yield light merely through the instrumentality of the gas, or by reason of the incandescence of the negative electrode, or both. In this lamp the resistances at different points may be different at the time of starting from what they are when the lamp is running; but by properly adjusting the gas density the lamp may be made to start on the same current that it is designed to operate on.

A lamp of the character described will regulate its resistance so as to be operative under wide fluctuations of e. m. f. Under increments of current the resistance of the heated cathode may increase; but this increase is compensated for by the change in resistance of the conducting gas or vapor through wide limits. In this way a balance is brought about between the elements composing the luminous portions of the lamp, whereby the lamp is made self-regulating. When the lamp is operated by alternating currents, both electrodes may be regarded as cathodes. It is desirable that the material in the lamp should be such that there shall be no chemical action or physical change in the lamp while in operation.

The two lower figures of the illustrations show a modified form of the lamp, in which the cathode is surrounded by an anode made in the form of a ring.

Long Telephone Lines.

Mr. R. Guenther, U. S. Consul at Frankfort, Germany, says: Paris is the center of an international telephone wire net; its extreme ends are London, Hamburg, Berlin, and (in connection with the French-Italian line about to be opened) Turin and Milan. The Paris-Berlin line is the longest, with about 625 miles of wire. The Paris-Hamburg line is about the same. The distance from Paris to Turin, measured by an air line, is about 375 miles, and that between Paris and Milan about 470 miles. But all these lines are eclipsed in length by that between Paris and Cologne, not by the direct line, but by indirect connection, often rendered necessary by breaks in the other service. In such cases, a person in Paris desiring to speak to Cologne is connected via Berlin. This roundabout way increases the wire distance about 375 miles, making the total about 1000 miles.

CURRENT NEWS AND NOTES.

FIRE IN SOUTH LONDON SUBWAY.—On Jan. 16, according to a London dispatch, a locomotive on the South London tube railway caught fire, owing to defective insulation. The fire spread to the sleepers on the roadbed, but as it was near a station it was soon extinguished.

ITALIAN FELICITATIONS.—President Cremona, of the Italian Societa Scienze dei Quaranta, has sent the American Institute of Electrical Engineers a hearty response of thanks to the cable message sent on the occasion of the annual dinner at which Mr. Marconi was the guest of honor on Jan. 13.

INSTITUTE MEETINGS.—The American Institute of Electrical Engineers will hold its next meeting at 12 West Thirty-first Street, New York, on Friday evening, Jan. 24. A paper will be presented by Dr. Cary T. Hutchinson on "The Relation of Energy and Motor Capacity to Schedule Speed in the Moving of Trains by Electricity." At the meeting of Feb. 28, the subject will be "Electro-Chemistry and Electro-Metallurgy." Dr. Samuel Sheldon will then present the opening paper.

FRENCH AUTOMOBILE TAX.—The incidence of an automobile tax is sometimes heavier than it seems. The French owner of two moto-cycles is in a predicament. He is obliged, according to law, to pay indefinitely annual taxes, despite the fact that the moto-cycles were stolen from him two years ago. His protest was rejected because of his failure to comply with the formality of bringing back the plaques attached to the moto-cycles, but which were stolen with them. Thus, as long as he does not return the plaques the law assumes that he still has the moto-cycles and must pay taxes thereon.

A NEW METHOD OF ELECTRICAL CONDUCTION.—A singular method of electrical conduction is the subject of a patent granted Jan. 14 to A. A. E. Sterzing, the object of which is stated to be to obviate the losses that occur when electric currents are transmitted through metallic conductors. The system consists of a pipe line lined with insulating material in which, after the air has been partially exhausted, vapor is admitted, the combination supplying a means whereby electric current may be conducted from a main supply station by various branches. An apparatus is described in detail, the function of which is to maintain the rarefied air and vapor in definite proportions at a definite pressure. The kind of vapor used, the proportion of air and vapor, and the amount of rarefaction are not mentioned, nor are figures given for the specific resistivity of the conducting medium whereby it may be compared with metallic conductors.

CHANGES IN MANHATTAN RAILWAY PERSONNEL.—The official opening of the Manhattan Railway as an electrically-operated system, which occurred two weeks ago, has been followed by a number of changes of considerable importance in the company's officers and staff. Mr. Hugh Hazleton, who has been assistant electrical engineer under Mr. W. E. Baker, has been made electrical engineer of the company. Mr. Baker, who has held the position of electrical engineer and general superintendent, will have charge of the operating department. Mr. M. M. Dorlan, who has been associated with Mr. Baker in his office at 32 Park Place, has been appointed supply agent, vice Ashbel Green, who retried from that position about two months ago to go into other business. The office at 32 Park Place has been abolished, all downtown business of the company being transacted at the main office at 195 Broadway, and Mr. Hazleton having his office in the main power station. Mr. H. G. Stott, who has been in charge of the work at the new Seventy-fourth Street power station and also of the distribution and substation work, retains the position of superintendent of motive power with full charge of the steam and electrical plant at Seventy-fourth Street. He will be assisted on the steam engineering side by R. D. Tomlinson, until recently assistant engineer of the Ninety-sixth Street power station of the Metropolitan Street Railway Company. L. B. Stillwell will remain as consulting engineer of the Manhattan Elevated Railway, as well as of the Rapid Transit Subway Construction Company.

"LORD KELVIN'S SON."—A youngish man, with one or two upper front teeth gone, has been calling upon electrical engineers in this vicinity and elsewhere as the son of Lord Kelvin, who is generally understood in this country to have no children at all. Among those favored with recent visit is Mr. T. A. Edison and Mr. Joseph Wetzler. A gentleman answering closely the above description has also been favoring street railway people with calls as the son of Mr. G. F. Milnes, of the Milnes Car Company, of Salop; and of Mr. Paget, of the Portsmouth municipal tramways. We understand from Mr. John Bottomley, Lord Kelvin's nephew, that he has not the honor of the young man's acquaintance.

RICHMOND, VA., TROLLEYS.—A special telegram from Richmond, of Jan. 14, says: This city, the scene of the first successful electric railway in the United States, built by Frank J. Sprague, will in a few weeks at most be connected with Petersburg by an electric line that will compete in speed and carrying with the steam roads. This road connecting the two cities is constructed substantially. Speeds of 50 miles an hour are talked of. The passenger fare between the two cities will be less than half what it is on the steam railroads. The electric line will carry express and freight. The original pioneer line in Richmond is owned by the Passenger & Power Company, which will operate the new system.

MUNICIPAL PLANTS.—Mayor Low's new Commissioner of Water Supply, Gas and Electricity, Mr. Dougherty, says: A bill introduced at Albany provides for the acquisition by the city of the various gas corporations in this city. I do not believe in the acquisition of these private properties because of their great capitalization, and consequently the tremendous expense involved in their purchase. The bill which I have referred to I have returned to Corporation Council Rives, together with a communication embodying these views. No doubt the control of lighting facilities by the city government will eventually be earnestly considered, but at this time it would hardly be judicious to recommend such an undertaking, owing to the proximity of the debt limit.

THE PHILADELPHIA ELEVATED RAILWAY.—A Philadelphia dispatch states that John L. Mack and President A. J. Cassatt, of the Pennsylvania Railroad, have come to an agreement, and that as a result an elevated railroad will be built on Market Street, running from the Pennsylvania Railroad station at Fifteenth Street westward to Sixty-third Street. Mr. Cassatt is said to have obtained the principal interest in the projected road, and there is a probability that in order to relieve the congestion of traffic on Market Street east of the City Hall there will be a subway built from Broad Street to the Delaware River. Nothing definite has been decided relative to Broad Street, but the rapid transit franchises provide for the construction of an elevated railroad on that thoroughfare, and it is probable that one will be built.

SOUTHWESTERN GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION.—The directors of the Southwestern Gas, Electric and Street Railway Association held a meeting in San Antonio on Dec. 22 last for the purpose of perfecting arrangements for the fourth annual convention of the Association, which is to be held in San Antonio April 18, 19, 20 and 21 next. Papers will be read on the following named subjects: "Fuel Oil," by H. F. MacGregor, of Houston, Texas; "Flat Rate Evil," by T. D. Miller, of Dallas, Texas; "Progress Clubs of Texas," by E. H. Jenkins, of San Antonio, Texas; "Office Management of Street Railways," by F. H. Stuart, of Waco, Texas; "Inspection and Inside Wiring," by W. B. Reed, of New Orleans, La.; "How to Increase the Business," by A. E. Judge, Tyler, Texas; "Personal Injury and Damage Cases," by F. E. Scovill, of Austin, Texas.

TESLA'S WIRELESS TELEGRAPHY.—When Mr. Tesla was asked last week by the *New York Sun* whether there was any similarity between his own and other wireless telegraph systems, he is reported to have said: "I respect rigorously the rights of others, and when I give my system to the world I shall ask the entire technical profession to point to any feature of my system—the transmitter, the receiver, the means and methods of recording, the means and methods of producing the requisite electrical energy, and the means and methods of securing absolute privacy and non-interference—which is not of my own creation. I admire skill and enterprise, and my best wishes for success accompany those who sell ready-made shoes; but I myself prefer not to use them. They are cheap, but they raise corns and bunions." The *Sun* adds: The Tesla patents in connection with instruments and principles involved in the transmission of wireless messages, or wireless electrical energy, date from 1896 and 1897.

LIGHTING THE VATICAN.—In a letter from Rome to the *Chicago Record-Herald* Mr. W. E. Curtis writes: "Cardinal Rampolla, the papel secretary of state, and, next to the pope, the greatest man in the Catholic Church to-day, lives at the top of the Vatican, and his visitors are required to climb 463 marble stairs. There are no elevators in that venerable building, although it has recently been fitted with electric lights at a cost of $45,000. It looks queer to have a clutser of electric bulbs hanging over an altar, but you can see this anomaly at the headquarters of the Catholic Church. The pope, whose apartments are immediately below those of Cardinal Rampolla, is carried up and down stairs in a sedan chair by four of his guards, who handle him as tenderly as if he were an infant. Everybody else has to walk, and it is a long, hard journey. When I suggested to an eminent prelate that the climb to the top of the Vatican ought to be counted as a penance, he smiled and said that he knew of a good many people who would be glad to get rid of their sins that way." American electric elevators would seem to be in order, all the same.

USE OF MARINE SEARCHLIGHTS.—It is stated from Washington that the complaints filed with the United States Treasury Department against the temporary blinding of the steamer pilots by the searchlights of other steamers, have become so numerous that an order fixing a penalty for it has been issued. These complaints came mostly from the Great Lakes, where the pilots allege that the searchlights of some steamers were often maliciously used against vessels of opposition lines, and the pilots of the latter vessels, blinded by the intense glare, were unable to see beacons or lighthouses for some minutes thereafter. When this happened in a narrow channel or where navigation was otherwise difficult, the complaining pilots assert that their steamers and passengers have been endangered, and in some instances they have been compelled to stop the engines. There being no regulations which would reach the offenders the Board of Supervising Inspectors of Steam Vessels, at its last meeting, adopted a rule prohibiting the practice. This rule has been embodied in the steamboat regulations by the following order issued last week by the Treasury Department: "That masters, mates and pilots of all vessels be required to exercise due caution in the use of their searchlights so as not to throw the rays of light into pilothouses of passing steamers. A wilful violation of the above requirement will subject the offender to a suspension or revocation of license."

ELECTROLYTIC SEPARATION OF TIN.—A curious parallelism is presented between the well-known Hoepfner process for the extraction of copper from its ores and compounds, and a method just patented to Paul Bergsoe, of Copenhagen, for the electrolytic recovery of tin from scrap and waste alloys. The Hoepfner process, it will be recalled, depends upon the varying valence of copper, and consists in bringing a salt of copper in its higher state of oxidation into contact with the ore, whereupon copper passes into solution and the solvent is reduced from the cupric to the cuprous condition; this solution is then electrolyzed with insoluble anodes to deposit one-half of its metal, restoring the remainder to its original valence and reconstituting the solvent. Bergsoe reacts upon tin-bearing materials with stannic chloride, and subjects the stannous salt formed to electrolytic treatment as above, restoring its valence and solvent power, and recovering an amount of metal equivalent to that dissolved. Both methods are simple, and indeed identical, in theory. The Hoepfner process has encountered in practice the very serious obstacle of a low-reaction velocity—a solvent action so slow as to render its application to the most commonly occurring ores of copper, the sulphides, of doubtful practicability. From this defect the new process is free, for the stannic salts are energetic solvents. The successful treatment of tin scrap, however, has proven in the past a difficult problem, not only on account of its very low tin content, but because of the tendency of the iron to pass with the tin into solution. As applied to this purpose, therefore, the industrial value of the new process is yet to be demonstrated.

LETTERS TO THE EDITORS.

Engine Specifications.

To the Editors of Electrical World and Engineer:

Sirs.—Referring to the communication by Mr. Bertram in your issue of Jan. 11, on engine specifications, there ought not to be any difficulty between the engine builders and the electrical people in regard to the driving of alternating-current generators in parallel operation. This whole question is simply a question of flywheel, and so long as the requirements of the generator do not necessitate impossible or impracticable flywheels, it seems to be merely a question of furnishing a wheel to meet the requirements of the case, and of making the price of the engine cover the extra cost of flywheel. The terms used by the electrical people in describing their requirements cannot be misunderstood, and if the engine builder uses his mathematics correctly he knows just what flywheel is necessary for any given result.

The governor of the engine has nothing whatever to do with this periodic displacement of the wheel, which occurs twice in each revolution while passing the centers. Of course, the governor must perform its function and must regulate the mean or average speed of the engine, and must prevent fluctuations or waves of speeds commonly called "racing" or "hunting"; but isochronism, or uniform speed, not only is not necessary in this case, but it is absolutely impracticable to divide the load between two engines satisfactorily unless the governors of both engines permit a moderate drop in speed with increase of load. All that is necessary in this case is for the governor to be stable in its action and not too near isochronism, and the flywheel must be depended on to maintain the uniform rate of rotation while passing the centers. It is, of course, desirable not to load the engine bearings with unnecessary flywheels, and, therefore, to decide the matter intelligently as to the weight of flywheel, it is necessary to know just what the requirements of the generators may be, and then not use any heavier wheel than is necessary to come safely within these requirements.

AMERICAN ENGINE COMPANY,
BOUND BROOK, N. J. F. H. BALL, *General Manager.*

The New York Tunnel Accident.

To the Editors of Electrical World and Engineer:

Sirs.—Referring to the conditions that led to the recent accident in the New York Central tunnel, it appears to me that the following system might prevent a similar occurrence.

Install a trolley bell circuit and supply each engine with a small trolley and a vibrating bell, one side of the latter being "grounded" on the engine. When on a "block" the bell will ring, and at the same time ground the wire behind it so that another engine entering that block will not get sufficient current to ring its signal bell—a warning of danger being thus given.

BRONXVILLE, N. Y., CYRUS PROSCH.

Death by Electricity.

To the Editors of Electrical World and Engineer:

Sirs—I read with great interest the two articles in the issue of Jan. 11 on the grounding of secondary circuits, and on a 19,000-volt shock. In connection with the latter article the question arises to my mind, "Does a shock of electricity, as ordinarily received, really kill?"

Some years ago I received a shock from a 2000-volt alternator, one side of which was grounded, and although I made a direct "ground" from the opposite side to a steel nail and was rendered unconscious for some hours, still I revived under artificial respiration and stimulants. Aside from a bad shaking up and a severe burn, I was none the worse for my experience.

Again, while I was in the testing department of a large electrical concern, I saw many students badly shocked and burned by voltages of various strengths, yet no case during my time failed to respond to the proper treatment.

In the course of my experience in the electrical profession of over 20 years, I have never lost a man, although I have had several so badly "shocked" as to be to all appearances "dead" in the accepted term, yet they all recovered after more or less prolonged treatment by the methods I have mentioned. The question to my mind, therefore, still remains an open one, whether a shock, as ordinarily received, i. e., from one path of potential, does "kill" a person who has not an organically weak heart. Indeed, is the criminal pronounced "dead" by electrical execution, *rcally* "dead," or does the autopsy kill him? though in this case he receives the full difference of potential. In view of the varying resistance of the human body this seems to me an open question, and I should be glad to hear other opinions on the subject.

LORAIN, OHIO. C. H. HINES.

(There is no doubt that the criminals executed by electricity in New York State are killed, the strength of current and the time it is applied producing lesions fatal to life.—EDS.)

Induction from the Secondary Into the Primary of an Induction Coil.

To the Editors of Electrical World and Engineer:

Sirs.—Having read the highly interesting article of Lord Rayleigh on the induction coil published in the *Philosophical Magazine*, December, 1901, which was printed in abstract in the Digest of ELECTRICAL WORLD AND ENGINEER, of Jan. 4, 1902, I attempted some experiments on induction from secondary into primary. I have been well aware for a long time that where a condenser or an earthed wire is used in the secondary circuit of a coil, under certain conditions, there is induction from the secondary into the primary circuit of the coil, and I have frequently had shocks when I touched any part of the primary when such an arrangement was used and the coil was in operation.

The experiment I performed was as follows: I connected a Geissler tube across the poles of a cell. There was a spark-gap in the secondary of the coil and a condenser consisting of a piece of mica with tinfoil glued on each side, one piece of the foil earthed and the other piece attached to the spark-gap in secondary of the coil on the one side. With this arrangement I found that the Geissler tube lighted up (discharged from one electrode to the other) with every spark discharge at the gap in the secondary. An earthed wire acted in the same manner on the condenser when substituted for it.

Without the condenser or the earthed wire I obtained no light in the Geissler tube. It is evident that the Geissler tube so arranged prevents the most part, if not the whole, of the high potential superinduced discharges from passing in or through the battery cell; and the tube does not allow any of the battery current to pass through it.

BALTIMORE, MD. A. G. DELL.

The Deterioration of Insulated Cables.

To the Editors of Electrical World and Engineer:

Sirs—In your issue of Jan. 4, under heading of "Deterioration of Insulated Cables," I note a letter to you from Mr. E. W. Stevenson, of Wilkesbarre, who quotes Mr. Paul Lincoln as attributing the deterioration of rubber insulated cables to the generation of ozone in the cables.

This subject is of much interest to me, as I have had the same experience as Mr. Lincoln; not only on rubber insulated cable, but also on saturated paper insulation. In my high-voltage testing work I have noted often a heavy static effect on the cable. This, of course, is due to capacity, and is especially strong on rubber covered conductors. I have also noted the process of a break down near the ends of the conductors where the leads of the transformer were connected, and in almost every case a static spark or, rather, a continuous discharge resembling an arc takes place at the point of break down. When this point has been examined, it was found to be circular and about 1/16 inch in diameter. The static discharge seems to bore its way through the insulation. I have checked this often by placing a

piece of soft rubber tubing around the conductor. If in any way we can discharge the cable, the deterioration will, it is safe to say, be greatly reduced.

Trusting that this will at least be a suggestion, I await with interest any new development of the subject.

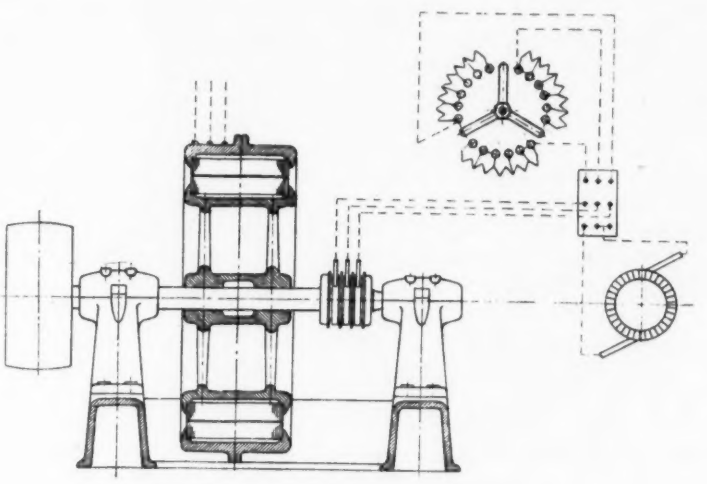
PERTH AMBOY, N. J. W. S. BREWSTER.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

DYNAMOS, MOTORS AND TRANSFORMERS.

Heyland Induction Motor.—HEYLAND.—An illustrated article on the first results of tests of his compensated induction motor. All properties, theoretically deduced by him before, have been substantiated by the test. The motor under test was a normal 12-hp, 330-volt, three-phase motor, with 6 poles, the speed being 1000 revolutions, the number of alternations 100. For the tests, however, it was connected up as a single-phase motor, two phases of the star connection being connected in series. The third phase was disconnected and a part of it was used for excitation. In this way it was possible to vary the connections and to connect in parallel and in series various windings of this phase, in order to obtain different voltages and currents, to adjust the compensation and to determine the most favorable conditions. The rotor was a direct-current series-wound armature, with 71 slots and 2 bars per slot, with a small collector for the exciting current, the segments being connected together by joints of low resistance and without inductance. The collector is thus a closed ring. The armature windings are closed through the collector rings, so that the rotor has the characteristic feature of the squirrel cage armature. In spite of very severe tests, not the slightest sparking of the brushes could be observed. This collector ring operates just as successfully as a slip ring. It is thought that experience will show that a very small number of segments is entirely sufficient. The excitation was produced with simple alternating currents, which were taken from the third phase of the stator and supplied to the armature through the diametrically opposite brushes. The excitation by single-phase current had the disadvantage that between the voltage at the brushes and the current of brushes there existed a phase difference. This was calculated exactly, and will be taken into account in the further calculations. The voltage was 2 volts, the current 200 amperes. This phase difference disappears with polyphase excitation. In the new motors polyphase excitation will always be used. In the experiments with the compensated motor the position of the brushes was first adjusted in such a way that the phase difference became a minimum, the brushes were then held fixed in this position and the number of windings was so adjusted that the phase difference became zero. For the motor, used as an ordinary induction motor without compensation, the power factor was 0.75, and the no-load current 15 amperes. With compensation the power factor was unity, and the no-load current 3 amperes. The greatest interest lies in the tests of the motor used as generator. The motor when mechanically driven and disconnected from the supply network, excited itself just like a direct-current dynamo, and supplied current to a number of incandescent lamps. As generator it shows the characteristic features of the self-exciting direct-current shunt-wound dynamo. As in the direct-current dynamo, it was found that a certain minimum speed was necessary for starting self-excitation. But this minimum speed was found to be 1100 revolutions, or 100 above normal as motor. The principal difference between this generator and the direct-current dynamo, is that the former has no fixed poles and no remanent magnetism. In the direct-current dynamo, the excitation increases with the speed, first on account of remanent magnetism and later by self-excitation. The Heyland generator has no remanent magnetism, and, therefore, after it has been brought up to the proper speed, the magnetization must be started from an outside source. A brief current is sufficient, taken from another source of alternating current. With proper arrangements it may be small, and and if there is no other generator available, it may be obtained from a small Siemens inductor. As soon as the machine is once excited, it continues to excite itself. The generator was then loaded with incandescent lamps, in groups of three in series, corresponding to a voltage of 330. The load was about one-fourth the normal load, and the voltage drop was only 2 per cent, although the air-gap between rotor and stator was very small, 0.5 mm., and the ratio of the armature ampere turns to the field ampere turns was 0.6. Apparently the armature reaction at the non-inductive load was entirely annulled by the induced short-circuit currents in the rotor, and the voltage drop corresponded entirely to the straying. For full load the voltage drop would, therefore, have been 8 per cent. He believes that not only for large generators but also for smaller ones his type of generator will be useful, as for the latter it is a great advantage to dispense with a special exciter.—*Elek. Zeit.*, Jan. 9.

Induction Motor Used as Synchronous Motor.—DANIELSON.—An illustrated article on a method for avoiding the production of the inconvenient phase difference of an induction motor. The principle is as follows: The non-synchronous induction motor operates in general with a phase difference in the primary circuit, the power factor being about 0.8 to 0.9 at full load. There is a double reason for this phase difference: First, that one component of the primary current must magnetize the total magnetic system, and, second, that there is magnetic straying in the motor. If it would be possible to obtain the magnetization in a different way and to regulate it at will, it would be possible to diminish the primary phase difference and even to annul it or make it negative. Theoretically, there are possibilities of obtaining this kind of magnetization, while the motor remains a non-synchronous motor; but in practice this would result in inconvenient complication. It is, however, possible to obtain the same result regarding the phase difference, by supplying a suitable direct current to the secondary winding of the motors. He considers the case of a three-phase winding of the rotor, connected in star. If a direct current is supplied through one collector ring and taken off from the two others, as indicated in the adjoining figure, then the current in one-third the winding is exactly double that in the rest



INDUCTION MOTOR USED AS A SYNCHRONOUS MOTOR.

of the winding. The distribution of the current is therefore exactly the same as though the winding were fed with three-phase currents at the instant when the current in one phase is a maximum. The motor is then changed into a synchronous motor, provided the direct current in the rotor is strong enough to yield an acceleration up to synchronism. Experiments with this method have been made by him in the plant of a Swedish electric company with an ordinary 20-hp induction motor, the normal voltage of which was 390, the magnetizing current 12 amperes, the ratio of the primary to the secondary winding 2.86, and the normal primary current 29.5 amperes. When it was desired to annul entirely the phase difference in the primary circuit, a current of 120 amperes had to be used. But under these conditions the operation would be uncertain, as no overloading

would be possible. The tests were, therefore, made with an excitation of 150 to 160 amperes, and the following results were obtained. The load could be increased up to 50 per cent above normal, before the motor fell out of step and began to run as non-synchronous motor, perceptible fluctuatins of speed and secondary circuit being observed. At constant excitation it was necessary to reduce the load to about one-half the normal, in order to bring the motor engine to synchronism. The negative phase difference at normal load corresponded to a power factor of 0.86 to 0.9. As the magnetic conditions of such an induction motor, running as synchronous motor, are about the same as in an ordinary induction motor, the ordinary formulas of the induction motor can be used with only slight modifications for calculating phase difference, overload capacity, etc. But it does not seem possible to calculate the load at which a certain excitation can bring the motor to synchronism. The author believes that this method may be successfully used in many cases, to remove troublesome phase differences. (The general idea of using a direct current in the field of an induction motor, is not new, however, as it is used on the Jungfrau Railroad for descending on grades when connection with the trolley wires, or between these and the station, is interrupted.)—*Elek. Zeit.*, Dec. 26.

Stability of Operation of Converters.—Leblanc.—An illustrated article on some peculiar unstable conditions in the running of converters. The first experiment described by him was made with a converter which was supplied with direct current from a storage battery that also furnished the exciting current. It gave out three-phase alternating currents which were raised in voltage by a transformer and then lowered again in voltage by a second transformer, and were then consumed in three rheostats. When the load of the converter was gradually raised, by varying the resistance of the rheostats, a time was reached when the speed of rotation ceased to be constant and began to vary between limits, which were the greater, the greater the load on the machine was. The second experiment described by him is as follows. A converter was used for converting alternating current into direct current for charging a storage battery. The converter operated well at full load, when its transformer was directly connected to an alternating current supply circuit. When it was desired to vary the voltage of the direct current an alternating-current booster was connected in series with the primary of the transformer. Oscillating movements of long period then arose in the converter, when the load attained half the value which had been obtained without difficulty without the converter. He gives the explanation, with the mathematical theory, of these phenomena. He shows that the critical limit of the load at which the oscillations arise, depends upon the coefficient of self-induction of the circuits through which the alternating currents flow. The armature reaction of the tested converter was very high.—*L'Eclairage Elec.*, Nov. 16.

Measuring the Slip.—Simek.—A brief communication on a stroboscopic method of demonstrating and measuring the slip of an induction motor. He observes marks on the rotor in the light of a Geissler tube, which is supplied with current from a small Ruhmkorff coil operated in parallel with the stator by a Wehnelt interrupter. He recommends the use of a Geissler tube, as it requires a small amount of power and lights up very precisely at every interruption.—*Elek. Zeit.*, Dec. 5.

REFERENCES.

Arrangement of Slots in Dynamos.—Corsepius.—An article on the properties of dynamos, from the point of view of the arrangement of the slots. The paper is highly mathematical and very long, and cannot well be abstracted.—*Elek. Zeit.*, Nov. 28, Dec. 5, 12.

Operation of Alternators in Parallel.—Franke.—A communication in which he makes some critical remarks on special points in a recent article of Meyer on this subject.—*Elek. Zeit.*, Nov. 28. There is a reply by Meyer in *Elek. Zeit.*, Dec. 19.

Theory of Commutation.—Punga and Wagner.—Two mathematical communications concerning the calculation of the reactance voltage.—*Elek. Zeit.*, Dec. 12.

Eddy Currents in the Pole Pieces of Direct-Current Machines.—Two further communications, one by Picou and the other by an anonymous writer, on this subject.—*L'Ind. Elec.*, Dec. 10.

POWER.

Motive Power from Blast Furnaces.—Donkin.—An abstract of a paper read before the (Brit.) Inst. Civ. Eng. The chemical constituents of the gases produced by smelting iron ore in blast furnaces varies according to the ores and fluxes used, the fuel burned and the temperature of the furnaces. On the average, they contain about one-third by volume of combustible gases, chiefly CO, the remainder being inert carbonic acid gas and N. With the present methods of utilizing these gases, about 10 per cent is lost by leakage, 28 per cent is applied to heat the air blast, 40 per cent to the boiler and 22 per cent is wasted. If the latter percentage is utilized in gas engines it would yield about 12½ hp-hour per ton of iron melted, while if all the gases were burned in gas engine cylinders to procure power, about 28 hp-hour per ton of pig iron would be available after deducting the power required for compressing the air. When burned under boilers they give a very poor heat efficiency, because the CO is of comparatively little value as fuel. At least four times as much power can be obtained when the gases are treated in an engine cylinder, the method of utilizing them being more suitable. The difficulties of this treatment and the method of overcoming them are discussed. He gives a sketch of the history of this new development in engineering science. The results of several tests are given. At the iron works of the Cockerill Company at Seraing, a trial has been made with a 650-hp single-acting and single-cylinder engine. The consumption of gas was 101 cu. ft. per brake hp-hour, and the thermal efficiency 26 per cent per brake-hp.—Lond. *Elec.*, Dec. 27.

Sault Ste. Marie.—A long illustrated article on engineering and industrial enterprises at Sault Ste. Marie. The three water-power plants, when completed, will develop about 100,000 hp. The combined industrial enterprises at the Canadian side alone will include a mill for "mechanical" paper pulp; a caustic lime plant operated by the Canadian Electro-Chemical Company; the Algorna iron works; a "chemical" or sulphite pulp mill; a nickel ore reduction plant, producing sulphur for the pulp mill and nickel for nickel steel; a complete steel rail plant with blast furnaces; a by-product coke oven plant; a by-product charcoal plant; an iron and steel pipe and tube plant. On the American side there will be a 20,000-hp carbide plant of the Union Carbide Company, and also alkali works. Brief descriptions are given of the different plants. At the nickel ore reduction plant sulphurous acid gas is produced from the pyrrhotite ore. The residue contains a combination of nickel and iron which, when treated by an electrolytic reduction porcess, produces an alloy of nickel steel of such quality that the Krupp works of Germany made a contract for a supply for five years. There will also be operated a new process for reducing copper pyrites. In this process sodium is required, and this is manufactured in the alkali plant. In the alkali works the Rhodin process is used, with a mercury cathode. Nine tons of bleaching powder and five tons of caustic soda are made daily. Electric power is used throughout the works.—*Eng. News*, Jan. 9.

Electric Crane.—An illustration, with brief description, of a three ton electric traveling crane. There are 17 of its kind used by a British railway company at its dock in Middlesbrough. A load of three tons is lifted at 150 ft. per minute, while half loads can be lifted at 225 ft. per minute. These speeds can be reduced at will. The crane mechanism is contained in the cabin of the attendant, who controls all the motions with one hand, his other hand being always on the brake lever. There is an automatic arrangement which puts on the brake when the current fails.—Lond. *Eng'ing*, Dec. 27.

REFERENCES.

Cost of Power.—Gray.—A long investigation of the cost of power. He discusses man power, animal power, wind power, water power, steam power, tests of steam boilers, engine tests, gas engine tests, oil engine tests. Finally, he discusses electric power. He gives a table of the cost of electric power in different places, deals with the efficiency of various electrical apparatus, the use of electric power for lighting, traction and transmission. The article contains many numerical tables.—*Jour. Frank. Inst.*, Oct., Nov., Dec.

Electric Steering Apparatus.—Heubach.—A detailed, well illustrated description of the electric steering apparatus of the Russian cruiser "Diana."—*Schiffbau*, No. 22, 23; *Elek. Anz.*, Dec. 12, 15, 22.

Machine Tools.—Littledale.—An illustrated paper, with several tables, on the speed of machine shop tools.—Lond. *Eng'ing*, Dec. 27.

TRACTION.

Electrolysis of Gas and Water Pipes by Tramway Return Currents.—Larsen and Faber.—An illustrated account of measurements made in Copenhagen. The main results are as follows: On the line which was tested and which has a length of 1210 meters with the rail joints in good condition, the stray current for cars in the center of the

line was about 10 per cent and for cars at the terminal of the line about 15 per cent of the supply current. The sum of the currents passing through gas and water pipes is in both cases about one-half the total stray currents. The total stray currents, as well as the currents in the pipes, are proportional to the supply current. During the service the currents in the pipes follow exactly the route of the cars. —*Elek. Zeit.*, Dec. 19.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

Maximum Demand System.—WRIGHT.—A very long paper, with many tables and diagrams, read before the British Inst. Elec. Eng. on "Some principles underlying the profitable sale of electricity." The several items of the cost of supplying electrical energy from a power station are closely analyzed, and the different systems of charging for electrical energy are critically discussed. At the end of the paper he proposes what he believes to be the best tariff, in two forms. First, a charge of x cents per unit for that part of the consumption which is equivalent to the use of the consumer's demand, for n hours a year—or quarter, or month, as the case may be—and z cents for any further consumption within the said period; x is taken as high as possible, and is preferably the maximum rate authorized; z is reduced as low as possible consistent with the cost of giving supply. Second, a yearly or monthly charge per lamp demanded, and a charge of z cents per unit for the energy consumed.—Lond. *Elec.*, Dec. 20, 27, Jan. 3. A good review of the main points of the paper in Lond. *Elec. Rev.*, Dec. 27.

An editorial review of the discussion which followed Wright's paper. Speakers attacked or defended both the principle and the expediency of the Wright system, the utmost diversity of opinion being expressed. The majority agreed that the Hopkinson theory, and the application made of it by Wright, are sound in principle. A notable exception was afforded by Mordey, who attacked the very foundations and ridiculed the practice of the system. He argued the system was wrong in principle, because when people go to church their house lamps are turned off, while the church lamps are turned on. It is, therefore, erroneous to suppose that any capital is locked up in plant specially allowable to the church installation. If the Wright system was right for electricity supply, why not for other lines of business. When we go on a railway journey "we ought to pay a shilling to go on the platform and a farthing a mile for the journey." On the question of expediency there was far greater diversity of opinion. Patchell led a minority who favored a simple system of charging. He claimed to have been able to develop an average load factor of 28.5 per cent on the Charing Cross and Strand system, adopting an ordinary level tariff with graded discounts. There appears to be in extensive favor a partial rather than a strict application of the Wright system. Andrews at Hastings goes back to the primitive Hopkinson tariff and charges a rental of $2.50 per lamp plus a level rate of 3 cents per unit consumed, but he recommends this tariff only to long-hour consumers. For the other consumers he has a simple fixed price per unit.—Lond. *Elec.*, Dec. 27.

Charging for Electricity.—WILKENS.—An article giving suggestions on the reform of central station tariffs for charging. He suggests using, besides the ordinary meter, another meter which registers the consumption of energy from October to February during the time of the maximum load of the station. By dividing these kw-hours by the hours, the average kilowatt during the maximum load of the station is known. It is preferable not to have two separate meters, but to combine them, by providing the main meter with a second counting device which is connected and disconnected at cetrain times by means of a watchwork. He suggests having this device count for two hours every day, which two hours are to be chosen, depends, of course, on the load curve of the station. He claims that such a system enables a simple and just tariff to be employed. A numerical example is given for a cigar store. A table gives in the first column the monthly consumption of kw-hours for the 12 months of a year; the second column gives separately the kw-hours consumed between 4.30 and 6.30 P. M. (maximum load of station) from October to February; the third column gives the cost of the kw-hours on the basis of 3.75 cents per kw-hour; i. e., the total kw-hours of the first column multiplied by 3.75; the next column gives the additional charge for the kw-hours consumed during the time of maximum load in the winter months from October to February, on the basis of 35 cents per kw-hour, the numbers of this column are, therefore, obtained by multiplying the numbers of the second column by 35; the next column gives the sum of the regular charge and the additional charge, i. e., the sum of the two preceding columns. As in the summer months there is no additional charge, and as the additional charge is much higher than the regular charge, the bill is considerably higher during the winter than the summer. Not only this, but the charge per kw-hour is also much higher in the winter than in the summer, about 20 cents against 3.75. But the average cost of the kilowatt during the year is nearly that which would follow from purely theoretical considerations given by him. It comes out at 12 cents.—*Elek. Zeit.*, Dec. 5.

The Future of Electricity Supply.—BARSTOW.—An article in which he calls attention to the fact that while the introduction of polyphase currents for transmission has greatly modified and simplified the details of the generating station, it has, up to the present time left undisturbed the distributing systems. The direct-current, three-wire, low-tension system, without any general modifications whatsoever, is to-day in the same position that it was 15 years ago as to its being the most economical and efficient system of distribution for compact territory. He believes that the most economical system of electricity supply for many years to come will be generation of polyphase currents in a generating station and transmission to sub-stations which supply the distributing systems already in use. He appears to believe in possible further consolidation of generating plants, by erecting a large plant of many hundred thousand horse-power capacity, located in close proximity to coal fields.—*Cassier's Mag.*, Jan.

Electricity Works Load Factors.—J. G. SCOTT.—The term load factor is used to express the ratio existing between the actual work done by a plant in a given time, and the possible work done by the same plant, if worked over the whole period at the maximum load recorded. This is the load factor of the load, as distinct from the load factor of the plant, which is the above ratio in which, however, the capacity of the plant is substituted for the maximum load recorded. It must be the aim of the station engineer to so adjust the charges for energy as to encourage consumers who will so influence the load for the improvement of its load factor. A diagram is given showing how the load factor varies for various classes of consumers. Probably the load with highest load factor met with in ordinary practice is that of a tramway system, on which cars are running more or less for, say, 16 hours daily, giving a load factor of about 66 per cent. Next in order comes public lighting, where lamps are burned on an average of 10 hours daily, giving a load factor of about 41 per cent. Then comes an ordinary motor load, say, for workshop purposes, which is in use, say, 50 hours weekly, giving a load factor of about 30 per cent. Motors in intermittent use will probably not give a very high load factor, but these will combine to favorably influence the load factor of the plant at the station. The best ordinary lighting consumer is probably the hotel or public house, but his load factor does not exceed about 12 per cent. The worst lighting consumer is a small office, with a load factor of about 1 per cent. He discusses at length different systems of charging, and especially the Wright maximum demand system, which he believes will come more and more into gerneral use.—Lond. *Elec. Eng.*, Dec. 20.

Explosion of a Transformer Box.—KUEBLER.—An article on a peculiar accident which recently happened in Dresden. In a transformer box (of about the shape of the round boxes or booths used by policemen for telephonic reports in several cities of this country) a new 5-kw transformer had been installed for supplying current to arc lights. In the night the transformer box exploded with very great violence. Several primary windings of the new transformer were found to be short circuited. He can give no other explanation of the explosion except that a workingman using a benzine soldering lamp may have left a bottle of benzine in the box.—*Elek. Zeit.*, Dec. 12.

HELLMANN.—A communication referring to this accident. He does not believe that Kuebler's explanation is the only possible one. It is quite possible that the transformer after having gotten hot, on account of the short circuit, had itself generated the gas required for the explosion. The materials used for insulation and impregnation are such that a combustible gas can be formed. He concludes that great care should be taken to have good ventilation in such transformer boxes.—*Elek. Zeit.*, Dec. 26.

ELECTRO-PHYSICS AND MAGNETISM.

Geometrical Loci in Alternating-Current Diagrams.—SCHENKEL.—An illustrated mathematical article. Geometrical loci are useful in the graphical investigation of alternating-current phenomena. They

reduce complicated diagrams to a few characteristic lines. An example is the circular diagram of the induction motor. He gives a simple method of determining the geometrical loci in alternating-current diagrams in an easy way by means of a simple calculation based upon Steinmetz's symbolic method and the well-known rules for the addition, multiplication and division of vectors. An example is given.—*Elek. Zeit.,* Dec. 19.

Magnetism of Electrolytic Deposits.—MAURAIN.—An illustrated account of experiments in which he tested the magnetic properties of thin electrolytic layers of iron, while they are formed electrolytically under the influence of a magnetic field. He measured the magnetization of the deposits for different values of the magnetic field, and studied the action exercised upon the formation by a variable magnetic field. The magnetic properties obtain a definite value only at a certain distance from the surface. When the iron is deposited upon an electrode of a magnetic metal, which had been magnetized before, the magnetization of the electrode causes a magnetization of the deposit of the same sense. He also studied this magnetizing action of the magnetized electrode when the deposit was not made directly upon it, but upon a thin non-magnetic layer with which the electrode was covered.—*Rev. Gen. des Sc.,* Dec. 15.

REFERENCES.

Discharge of Electricity from Glowing Platinum.—RUTHERFORD.—An illustrated account of an experimental investigation of the discharge of positive electricity from a glowing platinum plate. He investigates the variation of the current with the voltage, and of the current with the distance between the plates, and determines also the velocities of the ions by different methods.—*Phys. Rev.,* Dec.

Energy Dissipation in a Weak Magnetic Field.—PUPIN.—An abstract of a paper read before the N. Y. Acad. of Sc. on energy dissipation in a weak magnetic field. The substance experimented was a toroid of square cross-section, made up of iron plates 0.01 inch thick.—*Science,* Jan. 10.

Note on Magnetic Curves.—PAWLING.—A brief and purely mathematical article.—*Jour. Frank. Inst.,* Oct.

ELECTRO-CHEMISTRY AND BATTERIES.

Electrolytic Formation of Peroxide of Lead from Metallic Lead.—PETERS.—The first parts of an account of a long series of experiments. The electrolytic formation of peroxide of lead from metallic lead is of special technical interest for estimating the value of the methods proposed for the Plante formation. He investigated the physical properties of the active mass formed on the positive pole plates—especially the adhesion to the core—and also the quantities of lead peroxide obtained by the different methods. He made experiments with a large number of different electrolytes. In the following the numbers in parentheses after each electrolyte give the grams of peroxide which he obtained for 100 ampere-hours, with a current of 0.6 ampere and a surface of 144 sq. cm.: Sulphuric acid, 2 cc. acid to 1 liter water (0.7683 gram); 24 cc. acid to 1 liter water (0.7066 gram); 24 cc. concentrated sulphuric acid and 50 cc. methylalcohol to 1 liter water (1.1566 gram); 500 cc. sulphuric acid of spec. grav. 1.152 and 50 gram absolute ethylalcohol (5.6654 gram); 24 cc. concentrated sul- (28.5079 gram); 24 cc. concentrated sulphuric acid and 20 cc. formic acid of spec. grav. 1.06 to 1 liter water (21.3258 gram); 6 cc. conphuric acid and 10 gram hydroxylamine sulphate to 1 liter water centrated sulphuric acid and 4 cc. acetic acid of 90 per cent to 1 liter water (102.0218 gram); 24 cc. concentrated sulphuric acid and 10 cc. acetic acid of 90 per cent to 1 liter water (124.1715 gram); 24 cc. concentrated sulphuric acid and 14 cc. acetic acid of 90 per cent to 1 liter water (139.4303 gram); 2 cc. concentrated sulphuric acid and 2 cc. nitric acid of spec. gr. 1.18 to 1 liter water (0.8369 gram); 12 cc. concentrated sulphuric acid and 10 cc. nitric acid sp. gr. 1.18 to 1 liter water (108.6538 gram); 3.5 gram chlorate of potassium and 50 gram crystallized sulphate of ammonium and 70 gram sulphuric acid of 50 per cent to 1 liter water (100.5851 gram); 0.1 gram chlorate of potassium and 15 gram crystallized sulphate of sodium and a little dilute sulphuric acid (121.6361 gram); 6.6 gram of chlorate of potassium and 50 gram bisulphate of potassium to 1 liter water (117.4536 gram). (Theoretically, 100 ampere-hours could form 222 grams of lead peroxide. Comp.)—*Centralblatt. f. Accum.,* Nov. 15, Dec. 1, 15.

Carbon Electrodes for Electrolysis of Chlorides of Alkalies.—SPROESSER.—Continuations and the conclusion of his very long article, the first part of which was recently abstracted in the Digest. The author investigated the subject very extensively, and the results are given in a large number of tables. He found that the destruction of the carbons in the electrolysis of chlorides of alkalies is essentially due to an oxidation. Only exceptionally with special carbons is there a partial attack by chlorine, which, however, is of no great importance for the destruction of the carbons. The main product of the oxidation of the carbons is carbonic acid. Besides the loss by burned carbons, there is also a loss by carbon falling off unchanged. With some carbons this loss is great and may be greater than the chemical loss. The influence of temperature and current density are also investigated. Regarding the testing of the quality of anode carbons for practical use in the electrolysis of chloride of alkalies, he remarks that this examination can only be made by using them as anodes in a chloride solution. In no other electrolyte are there the same phenomena. The simplest way of making such a test is to electrolyze the pure chloride without a diaphragm. The output of oxygen then shows how far the carbon is similar to platinum as anodes. The higher the output the more suitable is the carbon to be used as anode for electrolysis of chloride.—*Zeit. f. Elektrochemie,* Nov. 14, 21, 28, Dec. 12, 19.

Capacity of Aluminum Cells.—FRANCHETTI.—An account of measurements of the electrolytic capacity of cells composed of two aluminum electrodes in a 20-per-cent solution of the double tartrate of sodium and potassium. He determined the lead of the current with respect to the pressure, by the three-ammeter method and also by plotting the curves obtained from a Joubert contact maker. At a constant frequency of 42, the capacity of the cell per sq. cm. of electrode was 0.058 microfarads at 87.5 volts; 0.083 at 162.5 volts; 0.127 at 171.5 volts. At about 200 volts the current rose very rapidly and increased as the electrode surface was diminished. The capacity is independent of the frequency, but the ohmic resistance decreases more rapidly than the frequency increases. The cell does not sensibly change the forms of the current and pressure curves.—*Rivista. Sci. Ind.,* Aug. 15; abstracted in *Science Abstracts,* Dec.

REFERENCES.

Measuring the Mobility of Ions.—ABEGG.—An illustrated description of an apparatus for demonstrating and determining the mobility of ions. The method, which is the one used by Steele in his experiments, has been described before in the Digest.—*Zeit. f. Elektrochemie,* Nov. 21.

Alkalies and Chlorine.—A continuation of the illustrated review, mainly from patent specifications, of new inventions in the alkali and chlorine industries.—*Zeit. f. Elektrochemie,* Nov. 28.

Dimensions of the End Cell Leads.—HUNKE.—A mathematical article, illustrated by diagrams, on the calculation of the dimensions of the end cell leads for batteries.—*Elek. Zeit.,* Dec. 5.

UNITS, MEASUREMENTS AND INSTRUMENTS.

A New Electric Teletachometer.—HOSPITALIER.—The simplest device used at present for transmitting to a distance the indication of the angular speed of a revolving axle, consists in mounting a small magneto on the axle and connecting the armature to a voltmeter. As the e. m. f. generated in the armature is proportional to the speed the reading of the voltmeter is also proportional to the speed. For this purpose it is necessary to determine the resistance of the connecting wires; the mounting of the small magneto sometimes also adds to the inconvenience. The new tachometer which he describes gives an exact reading of the angular speed, practically independent of the distances. It is in principle an extension of his ondonograph, noticed before in the Digest. A condenser of the capacity C is alternately charged from a battery of the e. m. f. E and discharged through a voltmeter by means of an oscillating contact maker, operated by the axle, the angular speed of which is to be determined. Each discharge of the condenser sends through the voltmeter a quantity of electricity $C\ E$, and if a is the frequency of the charges and discharges, the average current is aCE. The deflection of the voltmeter, the resistance of which is known, gives the value of this average current I, and the frequency a is the ratio of I to the product $C\ E$. Some details are given regarding the practical arrangement of the apparatus.—*L'Ind. Elec.,* Nov. 25.

Frequency Measuring Instrument.—LOEWY.—An illustrated description of an instrument in which an iron wire oscillates under the influence of an electromagnet, which is supplied with the alternating current, the frequency of which is to be measured. When the natural

period of the iron wire is equal to the period of the alternating current, there is a resonance phenomenon which can be easily observed whether by acoustic or optical means. The length of the iron wire is adjustable. The theory of the instrument is given and the construction is described and illustrated.—*Zeit. f. Elek.,* Dec. 8.

A Mechanical Slip Counter for Asynchronous Motors.—ZIEHL.—An illustrated description of an instrument for measuring in an easy way the slip and the number of revolutions of an induction motor, and at the same time the number of revolutions of the rotary field. By means of two revolution counters coupled together the relative speed between rotary field and motor is directly measured. One of the two revolution counters gives directly the number of revolutions of the rotary field, while the other gives the slip. The difference of both is the number of revolutions of the rotor.—*Elek. Zeit.,* Dec. 12.

TELEGRAPHY. TELEPHONY AND SIGNALS.

Influence of Leakage on Overhead Long-Distance Telephone Lines of the Pupin System.—BREISIG.—A mathematical article. In Pupin's mathematical theory the insulation is assumed to be perfect, the damping constant decreases continually with decreasing inductance per unit length. The present author takes into account a new constant of the line, which represents the reciprocal value of the resistance of the insulating material. Its value per unit length may be *a*. He shows that for a given frequency the damping constant becomes a minimum when the inductance per unit length equals the product of capacity and resistance per unit length, divided by *a*. In this case the currents of all frequencies are damped to the same degree. It would not be beneficial to diminish the self-induction below the limit given by this equation. A numerical example is given which shows that the constant *a* is of great importance for the practical application of Pupin's system on overhead lines.—*Elek. Zeit.,* Dec. 12.

Test of a Telephone Cable with Self-Induction.—BREISIG.—An account of a test of a telephone cable between Duesseldorf and Elberfeld. It contains 28 double conductors, seven consisting of wire of 2 mm. diameter, the others of wire of 1.5 mm. diameter. In the design of the cable it was desired to give it a relatively small capacity and a certain amount of self-induction, by keeping the twin cores of each pair in a certain distance, and by using insulated iron wires in connection with the conductors. The copper wires are first enveloped by iron wires in spiral form, they are then covered with paper, and two such cores are then twisted. The result is quite satisfactory. Elaborate tests were made by engineers of the German telegraph office, in order to investigate to what degree the distribution of self-induction in the cable had been accomplished. A full account of these tests is given, from which it appears that the distribution of self-induction has been successfully accomplished to the following degree: For the 2 mm. wires it is about 0.0038 to 0.004 henry per kilometer.—*Elek. Zeit.,* Dec. 19.

MISCELLANEOUS.

REFERENCES.

French Electrical Engineers in the United States.—A very full and complete report, by Janet, on the visit last summer of several members of the Internat. Soc. of Elec. Eng. to the United States and to the Buffalo meeting of the A. I. E. E.; descriptions by Courbier and David, of the principal installations visited; plants in Philadelphia and in New York, the Schenectady Works of the General Electric Company, the installations at Niagara and transmission to Buffalo, the MacGill University of Montreal, several Canadian water-power plants, stations in Chicago, and the Westinghouse plant at Buffalo. The report comprises 74 pages.—*Bull. Soc. Internat. des Elec.,* Aug., Sept., Oct.

New Books.

ELECTRICAL ENGINEER'S POCKETBOOK. A Handbook of Useful Data for Electricians and Electrical Engineers. By Horatio A. Foster, with the collaboration of eminent specialists. New York: D. Van Nostrand Company. 987 pages, illustrated. Price, $5.

Until this long-promised book made its appearance, all the important pocket reference books for electrical engineers came from abroad, and it will, therefore, be a great relief to American engineers to have at last one of American origin, by an American author, and based on the practice in this country. The author needs no introduction to Americans. As an engineer who has had an experience in many branches of work, he has enjoyed excellent opportunities to know the needs of the profession, and this book evidently embodies the result of many years of compilation. A very valuable feature of the book is that each section or chapter has been revised by one of a number of specialists, many of whom are well known authorities. This makes the book to a certain extent the work of a multiplicity of authors, and as no one man can be an authority on all the many branches covered by such a book, this adds very greatly to its value.

Necessarily, the first edition of a work comprising such an enormous amount of detail as the present one, is particularly open to criticism, and what criticism follows should, therefore, be viewed in light of this condition. On the whole, the work is highly creditable, and will, without doubt, eventually occupy the place in its field that Trautwine and Kent do in their respective fields. Indeed, the defects of this first edition scarcely affect its value in general, and we can unhesitatingly recommend it to all who have to deal with matters electrical.

The classifications of a work like the present dealing with a great diversity of subjects is a matter on which doubtless no two persons could agree. The author appears to have decided upon a classification by the more important subjects, under each general subject placing other subjects having relatively the closest relation to that particular one. As a result of this arrangement, the table of contents in the present case is limited to a mere list of 30 section headings. The objection to this arrangement is that it compels one to look over as many as a hundred pages in some cases to find the specific part of a section that he is looking for, or to locate it by means of the index, which should be unnecessary. Since almost all of the details of transmission of power, for example, are thus allotted to other sections, this subject is limited to only three pages, which is devoted to general references to other parts of the book, and as the page references are omitted through a blunder in proof-reading, and the sub-headings are not in the contents, one is apt to be compelled to start on another search. The very important subject of the calculation of a transmission scheme is not given there, and the reference to another part of the book where it is given is omitted.

The index in the back of the book, which next to the data itself is the most important feature of a reference book, might be considerably extended. More numerous cross references are desirable, as one is often compelled to look up many synonymous terms before he happens to find the one under which the desired data has been placed by the author. The index, indeed, does not do the book justice, as many things will be found in the book to which one would not be led by the index.

Referring again to the system of classification, the data concerning heat energy is scattered through many parts of the book, from near the first to near the last page. Batteries are not under electro-chemistry where they naturally belong, at least in a scientific classification. Measurements are scattered all through the book, notwithstanding that there is a separate section for them, though this appears to be intended only for general methods. It may be justifiable to put dynamo measurements, for instance, under dynamos, but in such cases, however, there should be a cross reference. Throughout the whole book, the author seems to have shown an aversion to multiplying cross references, notwithstanding the extreme importance of this time-saving means in a work of reference. In this way the author has indeed not done his own book justice, for it will be found to contain more information than one would suppose in looking up a subject, owing to the want of proper facilities for finding the greatly scattered and arbitrarily classified matter.

There are in the book some evidences of carelessness, sometimes even of gross carelessness. In several cases abbreviations and symbols are used in the book which are not explained, nor are they in the table of symbols on the first page. In that table definitions of symbols are given, and a few lines below in the very same table different symbols are used for the same things. The symbol for intensity of magnetism is wrong, and different from that given elsewhere in the book. In one instance, the term "magnetic force" is used for "magnetomotive force." Formulas are soemtimes given in which the meaning of the characters or the units of measurements to be used are not stated. The word "sum" is used when it should have been "algebraic sum." The letter *I* is stated to be the symbol for current, yet *C* is occasionally used elsewhere in the book. Those most important units, kilowatt-hour, horse-power-hour and horse-power, are not mentioned in the table on the first page, which is supposed to contain the symbols of all the units employed in prac-

tice. Different terms are used for the same units in different parts of the book. From the definition of e. m. f. one might suppose it ceases to be one when no current flows. The internal resistance of a cell is given without stating the dimensions of the cell. The terms energy and work are at times used as though they were different. Electrostatic voltmeters are separate from other voltmeters and placed under condensers. Ohm's law is given only under measurement of resistances, and the rules for determining the direction of a current are under dynamos. Although there is a section under coefficients of inductance (which term is itself incorrect) the term coefficient of self-induction is defined elsewhere. The allowable insulation resistance of house circuits is under measurements. Measurements of e. m. f. are partly in one place and partly in another. In general, the methods of measurements by the plan of the book are widely scattered. The subject of wiring is also scattered over many sub-sections, without cross references. In some cases no rules or laws are given, there being only a numerical example. Much will be found under miscellaneous that would be looked for under section headings. In short, the reader will have to master the author's system of classification before he will in all cases be able to refer rapidly to information sought.

A disproportionately large and valuable part of the book is devoted to the construction of electric railways, or in general, to traction, as it contains much that is not electric, but belonging to civil and mechanical engineering. Electro-chemistry as a subject is, on the other hand, limited to a few pages and only one of the many laws is referred to, even that is not actually stated, but is merely illustrated, and in the example the important subject of valency is not even mentioned, although a neglect of it may cause errors of several hundred per cent. Storage batteries are treated at considerable length in a separate section, quite removed from electro-chemistry; but it is devoted chiefly to their installation and contains numerous diagrams of methods of connecting them which are of use to the installing engineer as distinguished from the constructor of batteries.

The section on lightning conductors, though short, seems to be one of the best prepared. It was revised (probably written almost entirely) by Professor McAdie, one of the best American authorities on this much-neglected though very important subject. Two long sections on electricity in the Army and Navy, revised by Messrs. Powell and Crain, also contains good matter, though the information might have been classified and included in the various sections where each part belonged. The National Electrical Code is reproduced at length. There are two sections on miscellaneous matters (one of which is not mentioned in the table of contents) separated by another section placed between them, and finally a very long section—the longest of all—comprising nearly 200 pages, called the mechanical section, and containing non-electrical matter which, though indispensable to the electrical engineer, belongs more properly and is contained more fully in existing pocketbooks on mechanical and civil engineering.

From the publishers' standpoint, the book, though well bound and on good paper, is open to some criticism. The printing is not always clear, and some of the lines are broken and shifted, and there are a number of annoying typographical errors.

To summarize, the book as a whole contains a large collection of compiled matter from good sources, most of which will be of direct value to the electrical engineer, more especially to the contractor and practicing engineer; but the arrangement of the matter is open to question, while the fact that it is not of a general encyclopedic nature will be regretted by many who are in need of such a pocketbook of reference.

BOOKS RECEIVED.

LIGHT, HEAT AND POWER IN BUILDINGS. By Alton D. Adams. New York: Wm. T. Comstock. 102 pages. Price, $1.

POWER AND POWER TRANSMISSION. By E. W. Kerr. New York: John Wiley & Sons. 356 pages, 264 illustrations. Price, $2.

New Telephone Apparatus for Hotels.

The Kellogg Switchboard & Supply Company, of Chicago, is now making a high-grade telephone set for hotels, residences and such places where a small compact set is desirable, one of which is shown in the accompanying illustration, introducing its new transmitter. The equipment of this set is standard, and has the same type hook switch, ringer, receiver and transmitter as the regular Kellogg central energy apparatus. The base contains a condenser manufactured by this company, which is known for its prominence as manufacturer in the United States of condensers for telephone purposes. There are no binding posts or any other parts exposed that can in any way get out of order. The bell tapper is covered with a small guard to prevent people from changing the adjustment or in any other way getting the ringer out of order. The instrument is warranted to give satisfaction and may be used for as long distance work as the company's regular standard central energy sets. There is no doubt that this new line of apparatus will meet with success and be much appreciated.

HOTEL TELEPHONE.

Northwestern Convention Notes.

THE EXHIBITS at the Northwestern Electrical Association winter convention at Milwaukee this year, while not extensive, comprised some of the recent improvements in small apparatus most interesting to electric light central station men. About half the parlors on the second floor of Hotel Pfister were occupied by supply men as exhibition and reception rooms.

THE FT. WAYNE ELECTRIC WORKS introduced to notice its new Wood arc lamp for series alternating-current or direct-current circuits, which bore many refinements of detail appreciated by the practical man in care of arc lamps. Mr. Wood, by his long experience in designing arc lamps, has been able to produce a lamp which is remarkably easy to get at for renewal or adjustment. The wearing parts are ingeniously designed so as to be very simple and cheap of manufacture. If any prospective purchaser fears that cost of repair parts will be high, he can be given a pocketful of wearing parts—enough to last years. The clutch is simply a brass ring, which is tilted to draw up the carbon. It bears on three surfaces around the ring. The clutch acts directly on the carbon rod. The gas cap is cast in one piece with the bottom plate of the part which contains the mechanism, but ribs are provided on the top of the gas cap so that the heat of the gas cap is radiated away. All the bushings for electrical terminals in the gas cap are placed in bosses, which make it difficult for carbon dust to accumulate around the bushing. The globe holders have springs in the clamps, which reduce the danger of breakage if a globe is dropped the length of the chain. A tiny ball prevents the bottom carbon from dropping out, while the lamp is being trimmed after it has been unclamped. The feed is accomplished by series and shunt coils acting on opposite ends of a pivoted armature. When the voltage of the arc reaches the feeding point the shunt coils suddenly draw up their end of the armature and allow the carbons to come together, after which the series coils instantly strike the arc anew. The arc is always struck at a definite length. There is nothing likely to cause sticking in this feeding operation as the movement is decided and quick. Another novelty

this company was showing is a revolving fan motor. The fan is of the ordinary high-speed type, driven by a spherically incased motor suspended from an incased ball bearing, so as to revolve around a vertical axis. The fan being inclined so as to throw air down, the effect is to cause the fan and motor to revolve because of the greater distance from the center of rotation of the top blades. If the fan is hung from a chandelier it puffs air by rotation at all parts of the room. It is claimed that in this way the bad effects of sitting in a continuous breeze from a fan motor are eliminated, while the cooling effect is obtained not only in one direction, but in all parts of the room. The company's induction meter, with aluminum disk and case, was also shown in several styles. E. J. King, of the meter department, was present, and read a paper at the convention. W. C. Knight and Walter S. Goll were in charge of the exhibit.

VAN RENSSELAER LANSINGH & Co., illuminating engineers and agents for holophane globes and pagoda reflectors, with stores recently started both in Chicago and Milwaukee, set up an improvised dark room in one of the hotel parlors, where passers-by could easily compare the useful downward illumination obtained with a 16-cp holophane covered lamp and a 32-cp bare lamp, much to the credit of the former. A large number of holophane globes were shown, both in this parlor and around the meeting room and hotel lobby. Mr. Lansingh, of Chicago, was assisted by A. A. Ernst, manager of the Milwaukee branch. Mr. Lansingh has begun an active campaign for the better use of illuminants in the Middle West, and already has important contracts under way.

THE BELDEN ARC LAMPS, made by the Dayton Fan & Motor Company, were the prominent feature of the M. B. Austin & Co. exhibit. E. H. Belden, the designer and inventor of this line of lamps, was among the convention visitors, and many central station men took opportunity to have Mr. Belden explain fully to them the many refinements in the design of these lamps. As they have been described before in these columns, extended mention of their features will not be necessary. It suffices to note again their extreme simplicity and accessibility, and the placing of the coils and mechanism high above the heat of the arc. There are two general styles, large and small, the former for outdoor use and the latter for indoors, both being of the same capacity. The latter is very small, are very neat in appearance. These lamps feed by differential coils and clutch acting directing on the carbon rod.

M. B. AUSTIN & Co., of Chicago, received callers in parlor 21, where A. Meinema, A. H. Friend and W. W. Geisse were on hand. Mr. Geisse, formerly of the Central Electric Company, is a recent aquisition to the Austin ranks, and will travel in Iowa and Nebraska. This company is agent for the Belden arc lamps.

THE FEDERAL ELECTRIC COMPANY, of Chicago, represented by Jas. M. Gilchrist, made an exhibit of one of its patented illuminated electric advertising signs, with the lights flashed on and off by a New Reynolds flasher. This was a suggestion to the central station men as to a possible way of securing a profitable all-the-evening load. In some cities the electric light company furnishes advertising signs free to storekeepers for the sake of the additional revenue they bring.

THE DEARBORN DRUG & CHEMICAL WORKS, of Chicago, represented by James W. Harkins and Elborn T. Ward, entertained and distributed loaded cigars at one of the Pfister parlors.

THE VISCOSITY OIL COMPANY, of Chicago, received its friends at parlor headquarters and gave away souvenir bottles of pure petroleum cream. Samuel A. Johnson, president, and Frank Travers did the honors.

THE ELECTRIC APPLIANCE COMPANY, of Chicago, was represented by W. P. Upham and J. B. McMullin, who exhibited the Gutmann wattmeter and other appliances, and distributed souvenir pocket calendars.

THE MECHANICAL APPLIANCE COMPANY, of Milwaukee, had the largest exhibit in the hotel, which consisted of a number of unassembled and completed small motors, such as it makes for the Northern Electrical Manufacturing Company, which it represents. These are claimed to be the only motors of ½ to 2 hp, with form-wound coils and ventilated armatures. F. H. Ford, district manager, had charge of the exhibit, assisted by F. W. Trayeer.

THE COLUMBIA INCANDESCENT LAMP COMPANY was represented by James B. Coale, manager of the Northwestern office at Minneapolis, who brought along his photometer and testing instruments.

THE ILLINOIS ELECTRIC COMPANY, of Chicago, occupied one of the parlors with a few specialties and was represented by C. W. Bacon.

H. T. PAISTE COMPANY, represented by Edward A. Jenkins, Western manager, Chicago, had a novelty in the shape of a socket and lamp for variable light called the "Pinkard Tri-Light." The lamp for a 110-volt circuit contains two 8-cp, 110-volt filaments. When the lamp is full on the filaments are connected in parallel, giving 16 cp. By turning the key of the socket one filament is cut out, giving 8 cp. A third turn of the key connects the two filaments in series, making a very dim light.

THE GENERAL ELECTRIC COMPANY, as usual, had an able corps of representatives present—Thomas Ferris, Milwaukee; S. F. Dibble, O. E. Turner, Richard Swain, D. H. Beardsley, Chicago; H. C. Wirt and F. G. Vaughen, Schenectady.

THE WESTINGHOUSE ELECTPRIC & MANUFACTURING COMPANY exhibited its transformer construction and had a full supply of bulletins of interest to electric light men. Thomas James, Charles G. Burton and W. R. Pinchard, of Chicago, were in attendance.

THE BRYAN-MARSH COMPANY had its interests well looked after. Converse D. Marsh, of New York, was present one day, in addition to whom were L. P. Sawyer, E. H. Haughton and George Keech, of Chicago, and Guy V. Williams and Richard N. Young, of Minneapolis. This company had a photometer and dark room for the instruction of members.

JULIUS ANDRAE & SONS COMPANY, of Milwaukee, had an extensive display of the various electrical supplies for which it is agent, looked after by F. T. Andrae.

NON-EXHIBITORS.—In addition to those supply houses making exhibits or receiving visitors in the Hotel Pfister parlors there were, of course, many companies represented at the convention, some of which were as follows: Goltz Engineering Company, Chicago, William Goltz; Electrical Supply Company, Madison, Wis., L. W. Burch; Evans-Almirall Company, C. L. Etheridge, Chicago; Adams-Bagnall Electric Company, J. G. Pomeroy, Chicago; Pass & Seymour, Crouse Hinds Electric Company, John W. Brooks, Chicago; Warren Electric Manufacturing Company, J. Holt Gates, Chicago; W. H. Schott, engineer and contractor, Chicago; Chicago Insulated Wire Company, J. M. Graves, Chicago; Standard Underground Cable Company, W. A. Caldwell, Chicago; Western Electric Company, Harry Byrne, Milwaukee; George Cutter, Chicago; Peru Electric Manufacturing Company, George Searing, Chicago; McRoy Clay Works, E. F. Kirkpatrick, Chicago; W. P. Crockett, manufacturing agent, Chicago; Manhattan Electrical Supply Company, H. M. Pierce, Chicago; Wagner Electric Manufacturing Company, W. A. Layman, St. Louis; George B. Foster, Chicago; O. S. Norton & Sons Company, Sparta, Wis., G. M. Norton; O. C. Little Pulley Covering Company, O. C. Little; Guarantee Electric Company, Chicago, Charles E. Gregory; American Circular Loom Company, Thos. G. Grier, Chicago; General Incandescent Arc Light Company, Francis Raymond, Chicago; Sprague Electric Company, W. R. Mason, Chicago.

Tool for Electricians and Linemen.

A tool for electrical work, such as telephone, telegraph or any work where side cutting pliers, of a high-grade quality are required, is being introduced by the Smith & Hemenway Co. and the Utica Drop Forge & Tool Co., of 296 Broadway, New York City. It is a Swedish side cutting and splicing plier, made from the Swedish electro boracic steel, which has been tested for years, and found to be everything that is necessary to make a first-class article that will

SIDE-CUTTING PLIERS.

stand cutting the hardest kind of steel and iron wire without affecting the cutting edge.

It has their patent round edge, which is a great advantage, as it can be carried in the pocket without wearing or tearing the clothes. It is also very desirable where the workmen are liable to drop the pliers on the wire where they are working. Square edges will generally break the scale, thereby injuring the conductivity of the wire, while the patent round edge will not. It has polished head and jaws, and is finished half polished, polished or nickeled, in six different sizes.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Money closed at 4 per cent on call, and 4½ per cent for 30 days to six months on ordinary mixed collateral. In the stock market there was greater strength, despite the prevalent inactivity and the lack of public interest in speculation. There were a number of incidents during the week calculated to interest and stimulate activity, but their influence was not wholly favorable. The New York Central plans for the improvement of the Grand Central Station and the adoption of electric power in the Fourth Avenue tunnel, with the accompanying issue of $17,250,000 of new stock at 125, also failed to make any favorable impression on the Street. In the industrial list the principal activity centered in the United States Steel shares, which were rather heavy at the first of the week, but later there was a rally on the common and preferred, the former reaching 43⅜ and the latter 94⅞. Amalgamated Copper declined from 71¼ to 67⅝, but recovered to 70⅛, and was strong in the face of the further cutting of copper prices. In the traction list quietness prevailed; there were no marked changes, Brooklyn Rapid Transit closing at 65¼, a net loss of 1½ points, the sales aggregating 42,510 shares. Metropolitan Street Railway made a net gain of 1 point, closing at 164½, the sales aggregating 18,990. Manhattan Elevated closed at 136⅜, a net loss of 2¾ points. Inactivity and weakness characterized the electric list, General Electric closing at 279, being a net loss of 2 points. The sales aggregated 1400 shares. Westinghouse Electric common remained steady at 177; Western Union closed at 91, which is ¼ point less than the closing price of the week previous. Other closing quotations are as follows: American District Telegraph, 33½, a net loss of 2½ points; American Telegraph & Cable, 90½; American Telephone & Telegraph, 160¾. Following are the closing quotations of Jan. 21:

NEW YORK.

	Jan. 14.	Jan. 21.		Jan. 14.	Jan. 21.
American Tel. & Cable..	90	90	General Electric.....	276½	279½
American Dist. Tel.....	32½	38	General Carriage.....	1	1⅛
Brooklyn Rapid Transit..	63⅜	65½	Hudson River Tel.....	100	100
Ches. & Pot. Telephone..	—	—	Metropolitan Street Ry...	160¼	167⅝
Commercial Cable.....	155	161	N. E. Elec. Veh. Tran..	—	½
Electric Boat.....	25½	26	N. Y. Elec. Veh. Tran...	12½	11½
Electric Boat pfd.....	47	48	N. Y. & N. J. Tel.....	—	—
Electric Lead Reduc'n...	1¼	1⅛	Tel. & Tel. Co. America.	—	—
Electric Vehicle.....	2	2	Western Union Tel....	90½	90¾
Electric Vehicle pfd.....	4	4	West. E. & M. Co.....	170	174½
			West. E. & M. Co., pfd...	—	172

BOSTON.

	Jan. 14.	Jan. 21.		Jan. 14.	Jan. 21.
Am. Tel. & Tel.....	159	158	Mexican Telephone.....	2	2
Cumberland Telephone...	—	—	New England Telephone*	139	139
Edison Elec. Illum.....	—	280	Westinghouse Elec.....	—	—
Erie Telephone.....	19¼	19½	Westinghouse Elec. pfd..	—	—
General Electric pfd.....	—	—			

PHILADELPHIA.

	Jan. 14.	Jan. 21.		Jan. 14.	Jan. 21.
American Railways.....	44½	—	Phila. Traction.....	97	97⅞
Electric Storage Battery.	60	60	Philadelphia Electric.....	3⅜	3⅜
Elec. Storage Batt'y pfd..	60	60	Pa. Electric Vehicle.....	¾	—
Elec. Co. of America.....	5¾	5⅛	Pa. Elec. Veh. pfd.....	2½	—

CHICAGO.

	Jan. 14.	Jan. 21.		Jan. 14.	Jan. 21.
Central Union Telephone.	—	—	National Carbon pfd.....	82½	83½
Chicago Edison.....	163	163	Northwest Elev. com.....	38	38
Chicago City Ry.....	188	190	Union Traction.....	10	10
Chicago Telep. Co.....	—	—	Union Traction pfd.....	47	47¼
National Carbon.....	18¼	18¼			

*Asked.

CHICAGO TELEPHONE COMPANY'S REPORT.—The annual report of the Chicago Telephone Company shows a gain of 17,097 instruments or stations for the year, the total being 53,511, with 95 exchanges. This gain, which was equal to the whole number of instruments in use in the company's exchanges at the end of 1897, speaks for itself as to the success of the measured-service plan. Gross and net earnings were by far the largest in the company's history. Although the amount of capital outstanding at the end of the year was more than twice as large as that outstanding at the end of 1898 the surplus over dividends was larger than in that year. Thirty thousand shares, or $3,000,000 of new stock, will be issued this year to provide for extensions planned. The gross earnings were $3,775,001; the net $1,083,872, and the dividends $960,000. The balance sheet shows assets of $10,655,470, and surplus of $300,103, with a reserve of $343,471 for renewal of switchboards, etc. At the end of the year, 24,341 telephones were operating on the measured-service plan universal for some time past in New York.

BOSTON EDISON.—The steady advance in Edison Electric Illuminating stock has called attention, says the Boston News Bureau, to the commanding position of this company. Six months have elapsed since the merger of the Edison, Boston and Suburban companies, and while earnings of the combined companies for this period have made it clear to the leading interests that 10 per cent dividends can be indefinitely maintained, the real earning capacity has not as yet been determined, as the business has not been fully systematized. At a price of $259 per share the net return to the investor is 3.85 per cent, but considering the fact that for five years previous to this year, stockholders have received an average of $2 per share per annum through rights, and since the formation of the new company have received rights which sold between $3 and $4, it is figured that the actual return to the investor is between 4½ and 5 per cent per annum. While no increase in the dividend is expected, it is believed that stockholders will continue to benefit through the growth of the company, by rights to take new stock.

PHILADELPHIA ELECTRIC FINANCES.—President J. B. McCall, of the Philadelphia Electric Company, says: "The present needs of the company require an assessment of $2.50 per share and nothing more. The assessment will bring in $2,500,000. Of this $750,000 will be used to cover the expense of the acquisition of the Kensington Electric Light Company, which was a cash transaction. The balance, $1,750,000, will all be needed in connection with our new power plant which is to be erected at Christian Street Wharf on the Schuylkill River. In compliance with our agreement of Oct. 12, 1899, with the Land, Title & Trust Company, trustee, we have purchased and canceled $2,000,000 worth of the old Philadelphia Electric (so-called) bonds which were issued before we acquired the Pennsylvania Manufacturing Light & Power Company. We shall have no trouble in meeting our semi-annual interest payments on our own $15,000,000 issue of 4 per cent bonds. Three hundred thousand dollars of interest will be due on these next July."

BIRMINGHAM, ALA., IMPROVEMENTS.—Gordon Abbott, of Boston, president of the Old Colony Trust Company, met with other members of the executive committee of the Birmingham Railway, Light & Power Company, of which the Trust Company is trustees for bonds issued, last week, and the committee agreed upon the continuance of the development policy of the Birmingham Company. Street railway extensions and improvements to cost $1,000,000, the enlargement of the electric light and power plant at Bessemer at a cost of $200,000, the building of a $100,000 car barn at Birmingham, the doubling of the capacity of the electric light plant and the one-third enlargement of the gas plant at Birmingham were all agreed upon. Total expenditures will approximate $1,750,000.

PRODUCTION OF ALUMINUM.—It is said that the Pittsburg Reduction Company, of Pittsburg, is at the present time the only American producer of aluminum. It has three factories, one at New Kensington, Pa., one at Niagara Falls, N. Y., and one at Shawinigan Falls, Canada. The company has $600,000 6 per cent preferred stock, and $1,000,000 common stock paying 10 per cent, for which $250 per share has been bid in Pittsburg without effecting any purchase. In fact, no public sale has ever been noted. It is understood the company is earning more than it is paying in dividends, and is putting such surplus earnings into construction.

CLEVELAND TROLLEY MERGER.—At a joint meeting of the directors of three interurban electric railway lines, known as the Cleveland & Eastern, Cleveland & Chagrin Falls, and Chagrin Falls & Eastern railways, it was decided to merge the properties into one company. The new title will be the Eastern Ohio Traction Company. The capital will be $2,500,000.

SIEMENS & HALSKE ELECTRIC COMPANY.—Suit has been brought in Superior Court, Chicago, asking for the appointment of a receiver for the Siemens & Halske Electric Company, and to set aside the sale of the company to the General Electric Company. It is claimed that the merger was accomplished without the consent of the directors of the Siemens Company.

DIVIDENDS.—The trustees of the Worcester Railways & Investment Company have declared a semi-annual dividend of $2.25 per share, payable Feb. 1. The directors of Milwaukee Electric Railway & Light Company have declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable Feb. 1.

ERIE TELEPHONE.—A notice has been issued to Erie stockholders for a special meeting to vote on the sale and transfer of the property—to American Bell interests.

NEW HAVEN VS. TROLLEY LINES.—It is understood by the Boston News Bureau that the officials of the New York, New Haven & Hartford Railroad are making plans for a more determined competition with the trolley lines in Southern Massachusetts, particularly with the Taunton & Providence and the Providence & Fall River street railway companies. The competition with the former of these roads has hitherto proved quite costly for the New Haven. The fare on the trolley line is only 25 cents, against 60 cents on the steam road. The trolley road, moreover, from the center of Taunton to the center of Providence is 15 minutes faster. The competition with the Providence & Fall River has, however, been more successful. In this case both are electric lines, and both trolley systems. The time between Market Square, Providence, and City Hall, Fall River, is slightly in favor of the Providence & Fall River Company, and the fare on the latter is 5 cents less. The street railway has the advantage in that it meets converging lines both in Providence and in Fall River, making a transfer of passengers the mere stepping from one car to another, while in the case of the New Haven, an additional fare is usually paid in each city to reach one of its terminals. In summer, between these two cities, there is business enough to keep both roads in profitable operation. This winter, however, the New Haven is running, on practically half-hour schedule, trains which are almost empty. The people of the district, moreover, seem to favor the street railway. They say its officials are more easily approached, and that favors are more readily obtained. Besides this, many are financially interested in the street railway. This winter the New Haven has began to make extensive improvements, with a view of meeting this competition more successfully.

TELEPHONE CONSOLIDATION.—It is announced from Hagerstown, Md., that the Cumberland Valley Telephone & Telegraph Company has been purchased by the United Telephone Company, which is aiming at a system to compete with that of the Bell company. The combination of which the Cumberland Valley Telephone & Telegraph Company is now a part is to be known as the Cumberland Valley Telephone Company, and includes the Dauphin County Telephone Company, the Hanover Telephone Company, the Adams County Telephone Company and the lines for the most part as far south as Washington, D. C., as the underlying and constituent companies. In addition to these companies it has bought out many local companies in other sections, especially along the line of the Pennsylvania Railroad between Harrisburg and Altoona. The Cumberland Valley Telephone Company is but one branch of the United Telephone Company.

SAN FRANCISCO TROLLEYS.—The expected consolidation of all the San Francisco street railways will be announced shortly. Brown Brothers obtained options on all the principal street railways in that city and their experts are now looking into the proposition to determine whether the firm will supply funds for the consolidation. Brown Brothers say that they have nothing to give out in regard to amount of capital necessary for consolidation.

SOUTHERN NEW ENGLAND TELEPHONE.—The annual meeting of the Southern New England Telephone Company will be held Jan. 28 in New Haven, Conn. At the meeting a vote will be offered that the capital stock of the corporation be increased from $3,000,000 to $5,000,000. The company last year added 3316 new telephones in Connecticut, a much greater gain than the previous year, and increased the number of stations by 366 to 17,324.

Commercial Intelligence.

THE WEEK IN TRADE.—Coincident with the "January thaw" prices of securities, food products and copper, among the metals, all weakened and closed lower. The causes for this movement, according to *Bradstreet's*, have been in many cases technical, and the general trade situation has not on the whole been weakened, if anything, in fact, improvment may be expected to follow. In distributive trade the situation has improved. Among the industries, iron and steel lead in the volume of new business and in production, although the car shortage has materially reduced the December output of pig iron. Prompt deliveries command a premium, and the same is true of steel billets. The car shortage trouble has, however, been somewhat improved, but a number of furnaces are still banked, owing to insufficient supplies of coke. Finished products show an advancing tendency, and the advance in wire products is confirmed. Copper was deeply cut, 11 cents being now the nominal price, but claims are made of sales as low as 10½ cents without any particular improvement in demand reported, although exports are large. The United Metals Selling Company has decided not to announce "official" prices hereafter, but is selling at figures to meet the market. Since this announcement was made the cutting of prices continued steadily. The business that was transacted was on the basis of 11 cents for Lake, 10⅞ cents for electrolytic and 10⅜ cents for casting. The amount of this business, however, was very small, transactions being only of a retail character. The New York Metal Exchange quotes Lake 11⅛ cents, electrolytic 11 cents and casting 10¼ cents. According to *Bradstreet's*, last year was the best ever experienced by the railways in this country. Partial returns give a total of $1,423,283,295 as the gross earnings for the year, an increase of 10.4 per cent over 1900. The gains are general, the coal roads sending in one of 18 per cent; for the Southwestern, 13.8 per cent, and the Pacific Coast lines one of 13.3 per cent. The Granger lines show an increase of 9.5 per cent, trunk roads one of 9 per cent, and the Central Western carriers an increase of 8.8 per cent. Southern roads show the smallest ratio of gain, being 6.3 per cent. The business failures for the week, as reported by *Bradstreet's*, numbered 291, as against 346 the previous week and 290 the corresponding week last year.

THE WAGNER AND BULLOCK ELECTRIC COMPANIES, of California, have closed several important contracts in Southern California. The contract with the Edison Electric Company, of Los Angeles, calls for four Bullock 750-kw revolving field, three-phase generators. These machines are of the three-bearing type, direct-connected to waterwheel on the same base. Current is generated at 750 volts and raised by means of twelve 250-kw Wagner transformers to 33,000 volts. This apparatus will be installed in Station No. 3, and the distance of transmission to Los Angeles is 88 miles. An elaborately constructed switchboard will be installed. The Edison Company is a consolidation of all of the electric light and power plants tributary to Los Angeles, with the single exception of the San Gabriel Electric Power Company. The Los Angeles Traction Company has closed contracts, through the Wagner-Bullock Electric Companies, represented in San Francisco by Messrs. Cook, H. C. Wybro and R. H. Elder, for two 400-kw engine type, three-phase generators for railway use. Also for the necessary raising and lowering transformers, switchboard apparatus, etc. The San Bernardino Valley Traction Company has closed a contract for a Bullock 200-kw motor generator set, consisting of a synchronous motor and a railway generator direct coupled.

MACHINERY AND APPARATUS FOR JAPAN.—K. Sida, a representative of the Japanese Imperial Navy, was the guest of the Niles Tool Works at Hamilton, Ohio, a few days ago. He is in this country for the purpose of placing contracts for machine tools and electrical machinery for a new shipbuilding plant which the Japanese Government is preparing to establish. He will visit Pittsburg, Philadelphia, New York and other centers, and will then go to Washington, where he will be the guest of the Japanese Minister. Later he will go to Europe. He says Japan proposes to build shipyards which will render her independent of the rest of the world in this respect.

COPPER FIGURES FOR 1901.—Mr. John Stanton, the American copper authority, figures out United States production of copper in 1901 at 594,171,200 lbs., and exports at 213,619,840, leaving a home supply 140,000,000 lbs. greater than in 1900, and showing a decrease in production here of 1.3 per cent and in exports of 40 per cent. The European production in 1901 was 224,539,840 lbs., or 12 per cent larger than in 1900, and the largest on record.

STORAGE BATTERY.—Philadelphia papers last week quoted a director of the Electric Storage Battery Company as saying that they were going to have a large new factory so that they could compete with the General Electric and Westinghouse companies. Mr. Charles Blizard writes us that the item and report were entirely unauthorized.

CINCINNATI CONDUITS.—The Cincinnati (Ohio) Gas & Electric Company is going in for a very expensive and complete underground system, and Manager W. F. White telegraphs us that it has awarded a contract to Mr. Guy M. Gest, of that city, for about 1,000,000 duct feet of American Vitrified Conduit Company's multiple duct, laid complete.

INSULATED WIRE.—Conferences have been in progress in New York City during the past week between the associated supply dealers and the insulated wire manufacturers, as to a basis of prices on coated wires. It is understood that black core and white core have both been under very brisk discussion. Conclusions, if any have been reached, are not announced publicly.

LIGHTING PLANT BIDS.—The management of the new Hotel Rogge, at Zanesville, Ohio, has called for bids on a 500-light incandescent plant.

LARGE ORDER FOR CASTINGS.—The Craig Foundry Company, Toledo, Ohio, has received an order from the Westinghouse Electric & Manufacturing Company for 1800 tons of castings to be used in large generators. The contract price of the castings is $80,000.

THE STROMBERG-CARLSON TELEPHONE COMPANY, Chicago, has recently installed a direct-connected engine and generator in its plant, the Ball Engine Company, Erie, Pa., furnishing the engine and the Western Electric Company the generators.

EXPORTS OF ELECTRICAL MATERIAL AND MACHINERY.—The following are the exports of electrical material, machinery, etc., from the port of New York for the week ended Jan. 14: Antwerp—17 pkgs. material, $782; 2 pkgs. machinery, $117. Azores—2 pkgs. material, $25. Argentine Republic—41 pkgs. material, $331; 27 pkgs. machinery, $278. British Guiana—54 pkgs. material, $1,925. Bristol—2 pkgs. machinery, $600. Brazil—69 pkgs. material, $3,974; 15 pkgs. machinery, $5,026. British East Indies—281 pkgs. material, $4,286; 12 pkgs. machinery, $1,352. Berlin—5 pkgs. machinery, $411. British Australia—1 pkg. machinery, $205; 39 pkgs. material, $1,088; 82 pkgs. wire, $1,819. Bremen—4 pkgs. material, $214; 1 pkg. machinery, $350. British West Indies—35 pkgs. material, $1,434; 1 pkg. machinery, $50. Chili—11 pkgs. material, $736. Copenhagen—1 pkg. material, $11. Christiania—1 pkg. material, $131. China—2 pkgs. material, $30; 2 pkgs. machinery, $129. Cuba—220 pkgs. material, $3,796. Dutch West Indies—1 pkg. material, $18. Ecuador—4 pkgs. material, $135. Glasgow—4 pkgs. machinery, $973; 50 pkgs. material, $457. Hamburg—2 pkgs. machinery, $381; 39 pkgs. material, $405. Havre—65 pkgs. material, $2,175. Hong Kong—8 pkgs. machinery, $1,875. Hayti—1 pkg. material, $27. Japan—309 pkgs. material, $41. London—32 pkgs. material, $3,319; 59 pkgs. machinery, $1,214. Liverpool—8 pkgs. machinery, $1,521; 39 pkgs. material, $912; 6 pkgs. wire, $398. Manchester—1 pkg. wire, $37. Milan—4 pkgs. machinery, $201. Mannheim—7 pkgs. material, $400. Mexico—50 pkgs. material, $581. Newcastle—2 pkgs. material, $500; 2 pkgs. machinery, $705. New Zealand—1 pkg. machinery, $58; 1 pkg. material, $44. Portsmouth—16 pkgs. material, $861. Perth—25 pkgs. machinery, $1,800. Philippine Islands—19 pkgs. material, $900. Peru—2 pkgs. material, $36; 2 pkgs. machinery, $480. Southampton—12 pkgs. material, $947. Stockholm—2 pkgs. machinery, $75. St. Petersburg—6 pkgs. material, $262. Siam—1 pkg. material, $28. U. S. Colombia—2 pkgs. material, $97. Venezuela—34 pkgs. material, $372. Walsall—35 pkgs. material, $1,420.

TROLLEYS AND THE MERCHANTS' ASSOCIATION.—The annual meeting of members of the Merchants' Association, of New York, was held on Jan. 14, at which five directors of the board of fifteen were elected to succeed those whose terms expired at that time. The new elected directors are Mr. George F. Crane, of Baring, Magoun & Co.; Adolph Openhym, of William Openhym & Sons; George L. Duval, of Beeche, Duval & Co., each to succeed himself, and Mr. George Frederick Vietor, of Vietor & Achelis, to succeed Mr. Allan Trowbridge, and Herbert L. Satterlee to succeed Hon. John H. Starin. There were also three vacancies in the board, and these were filled, under the provisions of the by-laws, by the board of directors, who elected Henry R. Towne, president Yale & Towne Manufacturing Company; W. A. Marble, vice-president R. & G. Corset Company, and W. E. Curtis, formerly assistant secretary of the treasury under Mr. Cleveland. The president was authorized to appoint a committee to consider a number of subjects concerning the conditions existing in the city, among which were the question of street railway franchises, and the taxes alleged to be due the city in excess of taxes paid by the corporations enjoying these franchises. The question of unused car tracks still remaining in a number of streets. The laying of asphalt pavements in the business parts of the city; the question of the proposed franchise on Elm Street to the Metrolopitan Street Railway Company.

DECEMBER TRADE STATEMENT.—According to the trade statement published, December saw a slight reduction in our balance of trade, owing to smaller foreign demand. October, November and December are the months that always show the largest totals in foreign trade. It is notable that the excess of exports for December, 1901—$57,162,000—is, with three exceptions, the smallest for any of these months in the past four years. Compared with a year previous, last month's exports of $137,076,000 show a falling off of $8,813,000, and are $10,800,000 below the average of the months mentioned for the past two years. In fact, they fall so far below expectations that the confidently asserted prediction of $1,500,000,000 exports for the year fails of being reached by $34,500,000. Meanwhile the December imports—$79,914,000—are, with two trifling exceptions, the largest in many years, and exceed those of December, 1900, by $11,217,000. It is in the last six months that our balance of trade has suffered most by these tendencies. The exports in that time of $742,670,000 show a decrease of $23,238,000, and the imports of $446,447,000 an increase of $56,718,000. The excess of exports for this period is but $296,223,000, a falling off of $79,956,000—a total greater than the loss for the whole year, in which the excess of exports is $585,108,000, a decline from 1900's figures of $63,688,000.

THE ELECTRIC FURNACE COMPANY, of 52 William Street, New York City, is reported in the market for generators, transformers, turbines, etc. It was formed recently with a capital of $200,000, for the production of steel ingots from ore by an electric process invented by M. R. Conley, of Brooklyn, N. Y. It has secured the water rights in the Watuga River and a large tract of land near Elizabethton, Tenn., where it will erect two or three electric furnaces operated by an 8000-hp electric plant. Through a subsidiary company, under the name of the Electric Crucible Company, with a capital stock of $500,000, the furnaces are to be placed on the market for use in foundries and machine shops. The parent company is building a small furnace in the vicinity of New York City. The officers of the Electric Furnace Company are M. R. Conley, president, and Thomas T. Seelye, treasurer. W. B. Hutchinson is attorney.

MR. GEORGE BENDER, 137 Center Street, N. Y., reports that there is a large demand for first-class second-hand electric motors. Among last month's sales Mr. Bender reports the following: Mr. Charles Cooper, Bennington, Vt., one 10-hp and one 15-hp three-phase; Forsyth Iron Bed Company, Winston-Salem, N. C., one 10-hp two-phase; Prentiss Tool & Supply Company, New York, one 15-hp two-phase; William F. Mangles Carousal Company, Coney Island, one 10-hp two-phase; Briar Cliff Farm, N. Y., one 5-hp two-phase; E. Heller & Co., New York, one 2-hp two-phase; Moline Elevator Company, New York, one 10-hp direct current; Acme Manifold Company, one 7½-hp direct-current; Langer & Nagel, New York, one 6-hp direct current; Alex. Campbell Milk Company, Brooklyn, one 3-hp direct current; also several small motors. Mr. Bender is also overhauling 20 motors that went through a fire for the Collins Jute Company, New York City.

BIG ORDER FOR ELECTRIC WINCHES.—The two monster steamships which are now under construction at the Eastern Shipbuilding Company's yards near New London, Conn., for President Hill, of the Great Northern Railway Company's proposed Oriental freight service, are to be equipped with 76 electric winches—60 of 3000 lbs. capacity each, 12 of 5000 lbs. and 4 of 7000 lbs. These winches will be supplied by the Lidgerwood Manufacturing Company, of 96 Liberty Street. The 3000-lb. machines will be operated by 25-hp motors, and the remainder are to be direct connected to 40-hp motors. The electrical portion of the contract has been undertaken by the General Electric Company. The value of the contract is said to be about $65,000.

THE NEW PROCESS RAW HIDE COMPANY, Syracuse, N. Y., reports business as very good at the opening of the new year. The company is in receipt of an order from the British Westinghouse Electric & Manufacturing Company for 60 of its noiseless pinions for the equipment of the British Company's new plant. These pinions are to be used on motors for driving machine tools, electric cranes, etc., and are for transmitting from 5 to 40 hp. Orders from other sources are coming in fast, and the outlook is promising for a good business year.

PENNSYLVANIA ELECTRICAL CONTRACTORS.—The electrical contractors of the State of Pennsylvania held meetings in Pittsburg during last week and organized the Pennsylvania State Electrical Contractors' Association. The following officers were elected: President, G. F. Mathieu, of Pittsburg; vice-president, T. C. Smith, of Philadelphia; secretary and treasurer, F. F. Howe, of Pittsburg. Upon the completion of the organization the Association of Electrical Contractors, of Pittsburg, tendered a banquet to the guests at the Hotel Henry.

ST. LOUIS ELECTRICAL CONTRACTORS.—The following-named officers for 1902 were elected by the St. Louis electrical exchange at the last meeting: President, E. T. Cooke; vice-president, C. J. Ermer; secretary, William Murdock; treasurer, F. E. Newberry; sergeant-at-arms, C. J. Sutter. Directors: William Corrao, C. Smith, J. Masson, A. Eveschenstein, E. C. Van Nort and F. E. Adam. It was decided to change the name of the organization to the St. Louis Electrical Contractors' Association.

THE BULLOCK ELECTRIC MANUFACTURING COMPANY has secured the contracts for machinery and other equipment to be placed in the extension of the Cincinnati Gas & Electric Company's plant at Plum and Charles streets, Cincinnati, Ohio. All the machinery will be built at the Norwood plant of the Bullock Company. The Wagner Company, of St. Louis, will furnish the transformers.

FRED M. LOCKE, Victor, N. Y., the well-known manufacturer of high-voltage porcelain insulators, writes us that his plant was nearly destroyed by fire on Jan. 5, and is now being rebuilt in much better shape. He has on hand a stock of various sizes to fill small orders, and will be in a position to fill all orders promptly by the first of March.

WAGNER ELECTRIC MANUFACTURING COMPANY.—At the stockholders' meeting held Jan. 13 of the Wagner Electric Manufacturing Comapny the following directors were elected: S. M. Dodd, James Campbell, J. C. Van Blarcom, James W. Bell, Ferdinand Schmedtmann, W. A. Layman and S. B. Pike. S. M. Dodd was re-elected president and S. B. Pike secretary and treasurer.

DRIVER-HARRIS WIRE COMPANY.—A new factory is to be built at Harrison, N. J., by the Driver-Harris Wire Company, of Newark, N. J. As our readers are aware, the company manufacture at present resistance wires and fine wires of all metals. Other lines of wire manufacture will now be taken up.

General News.

THE TELEPHONE.

OPELOUSAS, ALA.—The Cumberland Telephone Company has just completed an exchange at Opelousas.

GLENDORA, CALIF.—The Farmers' Club of Glendora is taking steps towards the installation of independent telephone lines connecting their ranches. The farmers in the vicinity of Covina and San Dimas are expected to organize similar telephone systems which will connect with the Glendora system.

SAN FRANCISCO, CALIF.—The Pacific States Telephone & Telegraph Company is about to install an improved switchboard in the East Oakland exchange, Oakland, Calif. About 10,000 names will appear in the forthcoming telephone directory, which will include the subscribers of Oakland, Alameda and Berkeley.

ATLANTA, GA.—The Southern Bell Telephone Company will make arrangements at once to construct long distance lines connecting with Sumter, Florence, Darlington, Newberry, Union, Clinton, Laurens and Greenwood.

BUDA, ILL.—The Buda-Bradford Telephone Company has been incorporated with a capital of $5,000. The incorporators are George A. Carper, Parker N. Mason and John J. Gungrich.

PLAINFIELD, ILL.—The Northwestern Telephone Company has been merged into the Interstate Independent Telephone Company, with the same officers at the head. H. H. Evans, of Aurora, Ill., is president.

NEW PARIS, IND.—The New Paris Mutual Telephone Union, capital stock $100, has been incorporated. Directors: D. J. Whitehead, J. W. Rowdabaugh, F. J. McClure, Daniel Fisher and D. M. Weybright.

NEW CASTLE, IND.—Henry County, of which this city is the capital, now has 2303 rural independent telephones in use, and more building. The independent company in New Castle has begun work on its plant.

ROCKVILLE, IND.—Exchange of telephone service between this city and Marshall has been resumed by mutual concession. The directors of the two companies have entered into a new contract, by the terms of which tolls will be charged both ways. Thus the patrons of the Park County Telephone Company will pay in addition to the regular toll to Marshall 5 cents for the use of the lines of the Marshall system.

CADIZ, IND.—This village, with its 300 inhabitants, enjoys unsurpassed telephone facilities. Nineteen rural telephone lines, each with from 10 to 25 subscribers, center here, and the twentieth line is now building. All are controlled by one organization and have free connection with all towns within a radius of twenty-five miles, besides with rural lines in other sections. Long distance lines are being arranged for.

LOGANSPORT, IND.—During the summer the City Council granted a new telephone company franchise privileges in this city, and notified the Bell Company that its franchise, expiring Jan. 3, 1902, would not be renewed. The company has paid no attention to the notification, and continues business as of yore, and the City Council is apparently powerless to prevent its operation. The Council is now determined to prohibit extensions or improvements requiring a permit. Litigation is likely to follow.

LOUISVILLE, KY.—The Cumberland Telephone & Telegraph Company (Bell) has begun the distribution of 5000 free telephones as a result of the cutting of rates by the recently organized Home Telephone Company.

MONROE, LA.—The City Council of Monroe has refused permission to the Cumberland Telephone Company to stretch its long distance wires across the traffic bridge.

ST. JOSEPH, MICH.—The poor night service and the advance in rates have lost the Bell Telephone Company 300 out of its 700 subscribers in the twin cities during the first week of the year. A petition is being circulated among the Bell subscribers asking that the old rate be charged. The independent companies are putting in many new telephones.

SHREVE, OHIO.—The Ripley Telephone Company, capital stock $5,000, has been incorporated.

SATER, OHIO.—The New Baltimore & Venice Telephone & Telegraph Company has been incorporated.

CRESTLINE, OHIO.—The Crestline Telephone Company has increased its capital stock from $10,000 to $25,000.

SONNENBURG, OHIO.—Farmers hereabouts recently held a mass meeting and will organize a telephone company to build a farmers' community system.

OHIO CITY, OHIO.—The Ohio City Home Telephone Company, capital stock $10,000, has been incorporated by A. C. Bush, S. L. Ashton, J. A. Swovel, W. M. Smalley and Jesse Smith.

TOLEDO, OHIO.—The Toledo Home Telephone Company has received a large shipment of Stromberg-Carlson instruments which are being installed. The company will start with over 4000 subscribers.

MT. GILEAD, OHIO.—The Morrow County Telephone Company has bought up the system of the Sayers Telephone Company, which includes a large number of farmers' lines in the western part of the county.

WARREN, OHIO.—Citizens of Greene Township are organizing a telephone company to build a farmers' system. A committee has been appointed to secure estimates and arrange for connections with existing companies.

MARION, OHIO.—The Marion County Telephone Company, which was granted a franchise some months ago, has had the grant amended so as to permit it to place pole lines in all alleys instead of being forced to lay conduits.

LONDON, OHIO.—The Madison-Clarke Telephone Company has filed a mortgage covering all its property to the Cleveland Trust Company, Cleveland.

SHARON, OHIO.—A new telephone system is being is being installed in this place.

ASHLAND, OHIO.—The Central Union Telephone Company has commenced action in the Probate Court to secure a franchise in Ashland. The Council has repeatedly refused the grant. The Star Telephone Company has over 500 telephones in the town.

CINCINNATI, OHIO.—The City & Suburban Telegraph Association is building a number of lines in the vicinity of Hughes to make competition for the Hamilton, Hughes & Monroe Telephone Company, which is building a system in that territory.

URBANA, OHIO.—The Urbana Telephone Company held its annual meeting a few days ago and declared the usual dividend. The company is building lines to Kingscreek and is planning to build a system in North Lewisburg. Other improvements will be made.

WARREN, OHIO.—The directors of the Warren & Niles Telephone Company have authorized an expenditure of $25,000 for improvements to the exchanges at Warren and Niles. The company has 1200 telephones in operation, an increase of 160 during the past year.

BATAVIA, OHIO.—The Citizens' Telephone Company, of this place, has organized by electing B. W. Griffin, president; J. W. Ranson, vice-president, and W. H. Baum, treasurer and general manager. The company operates several hundred farmers' telephones in this county.

BELLAIRE, OHIO.—The Ohio Valley Telephone Company, of Bellaire, the Belmont Telephone Company, of St. Clairesville and the National Telephone Company of Wheeling, have arranged to give through service by connecting their lines on the bridge between Bellaire and Benwood.

FINDLAY, OHIO.—T. B. Stackhouse, of the Hotel Benton, has placed an order with the Findlay Home Telephone Company for forty telephones, one to be put in each room of the house. Each will be a regulation long-distance telephone with direct connection to the central exchange.

RAVENNA, OHIO.—The Ravenna Home Telephone Company has elected the following officers: E. R. Taylor, president; H. L. Beatty, secretary; W. S. Drake, treasurer, and George Wilson, manager. The officers and C. G. Fisher, C. C. Byers and C. H. Pitkin constitute the board of directors.

GUYSVILLE, OHIO.—The Guysville Telephone Company has been incorporated by H. S. Hoskinson, V. O. Satlder, E. D. Harper, O. L. Strahl, S. A. Wilson, J. H. Finsterwald and Jefferson Perry. The company will build a farmers' community system, connecting with other systems in this county.

RIDGEVILLE, OHIO.—The Ridgeville Telephone Company has elected new officers as follows: James Sayers, president; Frank Biggs, vice-president; J. P. Riedinger, secretary-treasurer and general manager. The above, with Frank Rollin and E. F. Allen, are directors. The company will build two new toll lines.

HILLSBORO, OHIO.—The Hillsboro Telephone Company has elected directors as follows: I. McSmith, M. F. Carroll, Frank Durnell, John Evans, John Horst, Charles Brown and George L. Garnett. The company has spent $13,400 in improvements the past year, but it was decided to make further improvements and extend the system to all parts of the county.

NEWTON FALLS, OHIO.—H. H. Porter has been re-elected president and C. F. Gardner, secretary of the Newton Falls Home Telephone Company. The company has just finished a very prosperous year. It has been decided to issue additional stock for the purpose of buying a new switchboard and making other improvements. The directors are calling for figures on a new board.

MECHANICSBURG, OHIO.—In order to settle a controversy between stockholders of the Mechanicsburg Telephone Company, Messrs. D. J. Burnham, H. C. Rogers and P. J. Burnham have submitted a proposition to buy out the other stockholders. The company has in operation 430 telephones. Its earnings for 1901 were $4,838, and total expenses $2,535, leaving a profit of $2,303.

FINDLAY, OHIO.—Judge Taylor, of the Common Pleas Court, has granted an injunction against the Findlay Home Telephone Company restraining it from charging more than $1 per month for residence service. The company's franchise provides that it furnish "regular exchange service" for $12 per year, but the company claims that it is furnishing long distance apparatus and demands $18 per year If the company continues the high rates other injunction suits will be brought.

CHILLICOTHE, OHIO.—The recent increase in rates made by the Central Union Telephone Company has been a good thing for the Chillicothe Home Telephone Company. The Home Company started in 1895 when the Bell Company was charging $4 per month and serving 148 subscribers. At present the Home company charges $1.50 and $2 per month and has over 1000 subscribers. The company has recently ordered a new multiple switchboard of 1200 drops capacity, and at the rate orders are being taken it is expected this will be filled within a few months. About March 1 the company will institute a selective four-party service, and this service will be furnished at $12 per year. The Home Company also has an extensive farmers' system covering practically the whole county. Branch exchanges have been established as follows: Frankfort, 90 telephones; Kingstown, 60; Roxable, 60; Bainbridge, 80.

OTTAWA, ONT.—The city of Ottawa, Ont., at the civic elections which were held on Jan. 7, took a plebiscite vote on the question of municipal ownership and control of its telephone service. By a majority of 1344 votes the ratepayers declared in favor of a municipal telephone system. The Bell Telephone Company's charter for Ottawa expires next year.

PITTSBURG, PA.—At a meeting of the board of directors of the Pittsburg & Allegheny Telephone Company, which was held a few days ago, Mr. G. R. Webb, of Baltimore, Md., the president of the company, resigned, and he was immediately succeeded by Mr. E. H. Bouton. Mr. S. H. Browne has been made the resident general manager of the company. Mr. Webb will not relinquish his interests in the company, and it is stated by those in authority that these changes in the official personnel of the company are indicative of the fact that the management recognizes the great field its company has in this district, and the intention is to push the interests of the company to the greatest extent.

UNION, S. C.—The Southern Bell Telephone Company is completing a new system in Union, with a capacity of 100 subscribers.

NASHVILLE, TENN.—The Board of Aldermen of Statesville, N. C., has unanimously refused a franchise to the Bell Telephone Company to build a system in that city.

SALT LAKE CITY, UTAH.—The Rocky Mountain Bell Telephone Company has 10,000 miles of wire in Idaho, and will add 4000 more this year.

MADISON, WIS.—The Calumet Telephone Company has increased its capital stock from $500 to $1,500.

MENOMONEE FALLS, WIS.—The village board has passed a franchise granting to M. A. Schmoyer & Company the right to erect poles and maintain a telephone system in the village limits.

OSHKOSH, WIS.—The Wisconsin Telephone Company is expected to spend $90,000 on its system in this city. It is very likely that a $20,000 exchange building will be built and $70,000 spent on underground construction and placing wires in conduits.

MERRILL, WIS.—At the annual meeting of the stockholders of the Merrill Telephone Company a proposition from the Bell Telephone Company to lease the local company was considered, but as similar offers have been declined by the local companies at Rhinelander, Grand Rapids and other Wisconsin Valley points, no action was taken, nor will be until it can be ascertained what the companies at Wausau and other cities will do. The Wisconsin company agrees to give up its local exchange in this city, which has been recently re-established, providing the Merrill company becomes a lessee of the Wisconsin Company.

ELECTRIC LIGHT AND POWER.

LA CROSSE, WIS.—The La Crosse Gas & Electric Company is spending about $100,000 on improvements, including new generators, new gas engines, etc.

BIRMINGHAM, ALA.—E. J. Oberne, of Birmingham, has secured the contract for constructing a water works system and electric light plant at Gloster, La. His bid was $22,538.90.

BIRMINGHAM, ALA.—The Birmingham Railway Light & Power Company has closed a contract with the Birmingham Machine & Foundry Company for two large Corliss engines, and new apparatus has been purchased from the General Electric Company, making all improvements cost $240,000. The capacity of the plant will be increased about one-third.

SAN FRANCISCO, CALIF.—The Mountain Power Company's preliminary work on the new hydraulic electric power plant in the Santa Ana Canyon in California, is progressing rapidly. Tunnels are being driven and hydraulic work is well under way for the No. 3 electric power house on Upper Mill Creek. These two plants will be arranged so as to be operated together whenever it is desirable.

SAN FRANCISCO, CALIF.—Mr. J. B. Crockett has resigned as president of the San Francisco Gas & Electric Company. Rudolph Spreckels, the son of Claus Spreckels, who founded the Independent Electric Light & Power Company, has been very active in securing proxies for the forthcoming annual election. Yet it is is said that he does not aspire to become president, but will practically control the affairs of the company with his present power as a director.

SAN FRANCISCO, CALIF.—The citizens of Cloverdale, Calif., recently took action for the formation of a stock company for the purpose of supplying the towns of Cloverside, Geyserville, Asti and Lyttons with electric light and power. Water rights have been secured at a point four miles from Cloverdale. It is purposed to construct dams at the junction of the two forks of Sulphur Creek, where sufficient water power can be developed. The Italian-Swiss colony of Asti will subscribe for half of the capital stock of the company.

CHRISMAN, ILL.—The Light & Water Company of Chrisman, with a capital of $10,000, has been incorporated by Geo. W. Farr, A. K. Hartley and Oscar Jones.

SPRINGFIELD, ILL.—The Cosmopolitan Power Company of Jersey City, N. J., has been licensed to do business in Illinois; capital stock, $40,000,000; capital in Illinois, $5,000.

VERSAILLES, IND.—A new electric light plant has been completed here and the tests are highly satisfactory. Business houses and many private residences are patrons of the new company.

BRAZIL, IND.—Interested parties have brought suit against the Mayor and City Council to break the contract recently made with the Brazil Power Company to furnish the city with electric light. It is alleged that the members of the Council are financially interested in the contract.

INDIANAPOLIS, IND.—The inside electric workers of this city and South Bend are now on a strike, with the exception of two firms, which have signed the new scale. The strike has practically tied up all the inside work in these cities, and there is no indication of an early settlement. The new scale calls for 32 cents an hour and eight hours a day. The contractors say they will not give but 30 cents an hour for nine hours a day.

ST. LOUIS, MO.—Contracts have been signed by the General Electric Company, of Schenectady, N. Y., and Chancellor W. S. Chaplin, of Washington University, for the power plant for the University's new buildings, which are included in the World's Fair site. Geo. D. Rosenthal, St. Louis representative, states that the plant will consist of three generators, one switchboard and twelve motors, to be used for lighting, power, ventilation, and for the laboratories. It is stated that after the expiration of the exposition other power will be supplied from plants down town for the University. The present plant will be used for the buildings during their occupancy by the Exposition Company, and later will be retained for the benefit of the students in their studies.

MARTIN'S FERRY, OHIO.—An issue of $8,000 bonds is being offered to provide for a new lighting plant.

ADA, OHIO.—The Ada Water, Heat & Light Company has been incorporated with $25,000 capital stock by local people.

ASHLAND, OHIO.—Postle & Barber, of Columbus are asking for a franchise in Ashland to furnish light, heat and power.

CLEVELAND, OHIO.—Director Dunn, of the police department, is having estimates prepared of the probable cost of a lighting plant for the central police station.

CINCINNATI, OHIO.—Bids have been asked for an engine and generator for the public library lighting plant. Wm. E. Hopkins has charge of the proposals.

CUYAHOGA FALLS, OHIO.—The water works trustees have sold $5,000 in bonds to purchase equipment for a municipal lighting plant, to be operated in connection with the water works.

WILMINGTON, OHIO.—Recently the town advertised for bids for an electric light and water works franchise, but no bids were received. Another attempt to secure proposals will be made.

CIRCLEVILLE, OHIO.—The Circleville Light & Power Company has been incorporated by William Heffner, W. E. Christ, Frank Millspaugh and others for the purpose of erecting an electric light plant.

ZANESVILLE, OHIO.—The Citizens' Light Company, of Zanesville, has been incorporated with $1,500 temporary capital stock by C. G. Griffith, Mrs. C. G. Griffith, O. S. Palmer, C. G. Barnell, John F. Murphy and E. J. Walsh.

HUBBARD, OHIO.—The village is still undecided whether or not to rebuild the municipal lighting plant which was destroyed by fire some time ago. It is probable that a proposition made by the Youngstown Electric Light Company will be accepted.

COLUMBUS, OHIO.—It is stated that the directors of the Panhandle Railway have appropriated $500,000 for improvements at its shops in this city, including an electric light and power plant. It is intended to use electric power in driving the shop machinery.

PORT CLINTON, OHIO.—The village contract with the local lighting company expired some months ago, and since then light has been furnished under a temporary arrangement, the Council declining to make a long time contract unless the company decreased its rates. The company has declined to make any concessions and the Council has ordered the service discontinued, so the town will be in darkness unless an amicable settlement is made.

EL RENO, OKLA.—The El Reno Electric Light Company has sold its plant and franchises to Mr. Henry Larsen, president of the Canadian Milling Company, and Mr. John A. Masters, formerly president of the Jamestown Electric Light Company, of Jamestown, N. D., and lately connected with the South Carolina Interstate & West Indian Exposition Company as assistant engineer in the Bureau of Light and Power. It is the intention of these gentlemen to organize a new company and replace the present plant with a modern plant of about 300 kilowatt capacity.

OTTAWA, ONT.—A by-law was carried, a few days ago, by the ratepayers of the town of Annapolis Royal, N. S., to enable the town to borrow $12,000 for the purpose of extending the electric light system of the town and to operate the plant by water power.

HAMILTON, ONT.—It is stated that the Cataract Power Company, of Hamilton, Ont., has reached the limit of the capacity of its present water power development, and the company is now considering the question of the construction of a canal and other works to furnish additional power. The cost of the necessary works will be about $80,000.

OTTAWA, ONT.—An order has been promulgated by the British Columbia government granting certain rights at Coquitlam Lake, B. C., to the Vancouver Power Company. Thus the company is in a position to commence work at once on the development of electric power there. It is proposed to develop 5000 horse-power, with an ultimate increase to 15,000 horse-power. In connection with this power scheme, a tunnel, two miles long, will be built.

WRIGHTSVILLE, PA.—The Wrightsville Hardware Company proposes to establish an electric light and power plant, to be operated by water power. The new plant will adjoin the company's present lumbering plants south of Williamsport on the Susquehanna River.

ABBEVILLE, S. C.—The plant of the Abbeville Electric Light & Power Company has been totally destroyed by fire.

ANDERSON, S. C.—The Anderson Water, Light & Power Company has awarded a contract to the Flynt Construction Company, of Massachusetts, to rebuild the dam at Portman shoals, recently washed away. The work will cost, it is stated, $125,000. The company has ordered a 300-horse-power engine and will, it is said, be ready to turn on lights on Feb. 1.

ROGERSVILLE, TENN.—The recently burned electric light plant of Rogersville will be rebuilt.

ESTILL SPRINGS, TENN.—The Tullahoma Electric Light Company has completed its line from Tullahoma to the new plant now in process of completion, on the south bank of Elk River, about two miles below Estill Springs. This plant will furnish power to light Tullahoma, Winchester, Dechard and Estill Springs.

NACOGDOCHES, TEX.—The Nacogdoches Light & Power Company of Nacogdoches has been incorporated with a capital stock of $20,000. The incorporators are E. C. Brauch, I. A. Sturtevant, K. P. Brauch and O. E. Hubbard.

DALLAS, TEX.—The Magnet Light, Heat & Power Company, of Enid, with $100,000 capital stock, has been incorporated. The incorporators are: H. E. Havens, W. S. Whittinghall, M. A. Kelso, J. A. Hill, J. W. Steen, E. B. Weatherly, O. J. Fleming, H. N. Horner and Charles H. Peters, all of Enid.

SALT LAKE CITY, UTAH.—The Utah Light & Power Company has been troubled this winter with the source of its water supply being frozen up.

SALT LAKE CITY, UTAH.—The State Board of Correction, of Utah, will ask for bids for a lighting plant to light the State prison at Salt Lake. Address W. B. Gowles, clerk.

SALT LAKE CITY, UTAH.—By Feb. 1 the mines and smelters of Butte, Mont., will be receiving electric power furnished by the Missouri River Power Company from its plant on the Missouri River. The dynamos and other machinery at the claim are all in place, and a trial run has been made.

SALT LAKE CITY, UTAH.—The Clark Electric Power Company has been incorporated at Los Angeles, Calif., by Edward W. Clark, of Ophir; Edwin M. Clark, of Los Angeles; Frank Pierce, E. B. Critchlow and W. J. Barrette. The chief business of the new company will be the impounding of the waters of Settlement Canyon Creek in Tooele County, and conveying the waters five miles by flumes to an electric power plant. The principal offices of the company will be in Salt Lake City. The capital stock is $50,000. The directors are Edward W. Clark, president; Frank Pierce, vice-president; W. J. Barrette, secretary and treasurer; Edwin M. Clark and E. B. Critchlow.

NORFOLK, VA.—An application has been received from the Geo. A. Williams Company of Jersey City for the appointment of receivers for the Consumers' Light, Heat & Ice Company, of Newport News, Va. The Williams Company has also filed mechanics' liens for various supplies, amounting to over $80,000, claiming that the defendants have made no payments for these supplies.

MENOMONEE FALLS, WIS.—The Wisconsin Beet Sugar Company has been granted a ten-year franchise to erect poles and string wires for electric street lighting purposes, also for heating and power purposes.

SUPERIOR, WIS.—The Superior Water, Light & Power Company will install a new gas plant in case an extension of its franchise is granted. It is also proposed to expend $60,000 in installing new machinery in the electric light station.

MILWAUKEE, WIS.—South Milwaukee may have an electric light system of its own. At a recent council meeting the subject was favorably discussed. The prices and attitude of the Milwaukee Electric Railway & Light Company are responsible for the agitation in favor of municipal ownership.

THE ELECTRIC RAILWAY.

HARTFORD, CONN.—The opening of the new street railway line between this city and Springfield took place on Jan. 13. The line connects this city with Springfield, Northampton, Westfield, Holyoke, Worcester and Boston. It forms a continuous line between Boston, Worcester, Springfield, Hartford and Meriden, where there is the first break in the proposed route to New York. It gives a total stretch of 135 miles of trolley road.

SPRINGFIELD, ILL.—J. B. Hanna, president of the Central Illinois Traction Company, which is preparing to build an extensive system radiating from Springfield, states that he is thoroughly satisfied that the financial embarrassment of the Everett-Moore Syndicate will have no effect upon the Illinois enterprise. Plans are going forward as though nothing had happened, and it is believed that operations will not be even temporarily suspended.

ELIZABETH CITY, N. C.—The corporators of the Electric Railway & Power Company have asked for a franchise for a local system. The lines will not be extended to Norfolk, Va., as previously contemplated.

NEW YORK, N. Y.—All of the employees in the power plant of the New York & Staten Island Electric Company at Livingston, Staten Island, struck work a few days ago. The cars were stalled all along the lines. The strikers stated that they would not work in the plant under Alexander Bain, who took the place of general foreman of the steam plant. J. H. Swinarton, the president and general manager of the company, secured from the officers of the Midland Electric Railway Company consent to connect with the feed wires of that company where the lines intersect, and the stalled cars were moved and the regular service was soon restored.

WELLSVILLE, OHIO.—The East Liverpool & Wellsville Street Railway is extending its line in Wellsville.

WOODVILLE, OHIO.—The Woodville Council has granted permission to the Lake Shore Electric Railway to double track its line through the town.

MT. VERNON, OHIO.—C. D. Smiley, promoter of the Mt. Vernon, Mt. Gilead & Western Railway, has applied for a franchise in Knox County.

TOLEDO, OHIO.—The Toledo City Council is preparing an ordinance to require the local traction companies to pay a license for cars operated in the city.

LODI, OHIO.—The Council has granted a franchise to the Canton, Lodi & Medina Traction Company. Several other franchises have recently been secured.

TREMONT, OHIO.—Citizens of Addison, Dialton, Dibert and Tremont have submitted a proposition to the Dayton, Springfield & Urbana Railway to build a spur line through these points.

DAYTON, OHIO.—The capital stock of the Dayton, Lebanon & Cincinnati Railway, which has recently been bought up by the Appleyard syndicate, has been increased from $500,000 to $2,000,000.

UPPER SANDUSKY, OHIO.—Residents of Upper Sandusky, Nevada and Bucyrus are projecting an electric railway to extend from Bucyrus to Lima by way of Nevada, Upper Sandusky, Forest, Ada and other towns.

NEW WASHINGTON, OHIO.—The Village Council has granted a 25-year franchise to the Buckeye Traction Company, which proposes to build a line from Bucyrus to Norwalk. Franchises have been secured in other towns.

CANTON, OHIO.—The Stark County Commissioners have granted a new franchise to the Stark Railway Company enabling it to build over a private right of way instead of along the highway as was originally intended.

CLEVELAND, OHIO.—The Cleveland Electric Railway Company is again considering the building of a new line through the "flats." It would touch two railway passenger stations and provide a shorter route to the South Side.

CLEVELAND, OHIO.—At the recent meeting of the Sharon Street Railway Company, Sharon, Pa., John H. Dynes and Fayette Brown, both of Cleveland, were elected secretary and member of the board of directors respectively.

XENIA, OHIO.—The Xenia, Cedarville, Jamestown & Wilmington Traction Company has been incorporated with $1,000 capital stock by J. E. Lowes, J. H. Wolford, H. C. Dean, M. J. Hartley, R. R. Gruire, W. H. Manning and D. E. Peddicort.

YOUNGSTOWN, OHIO.—The Mahoning Valley Electric Railway has completed its new power house at Edenburg, Pa. Several high-speed cars built by the Pullman Company, have been received for the through service from Niles to New Castle.

SPRINGFIELD, OHIO.—The right of way for an electric railway from Springfield to Sidney has all been secured and steps are being taken to finance the project. The road will be known as the Springfield, Piqua & Sidney Traction Company.

DAYTON, OHIO.—A. E. Appleyard, of the Dayton, Lebanon & Cincinnati Railway, has purchased land in Dayton valued at $80,000, to be used as yards, repair shop, round-house and power-house for the road, which is to be operated by both steam and electricity.

COLUMBUS, OHIO.—Representative Bannock has presented a bill in the Legislature giving conductors on interurban lines the powers of police officers whether on their cars or not. At present conductors on passenger trains have police powers while on trains.

ASHTABULA, OHIO.—The Pennsylvania & Ohio Railway recently made a proposition to buy out the Ashtabula Rapid Transit Company, but failing to close the deal, it has announced that it will build a line through East Ashtabula to Woodland Beach and Harmon Park.

BARBERTON, OHIO.—The Northern Ohio Traction Company has made a proposition to furnish lights to the town. If granted a five-year contract it will furnish lights for three cents per light per hour, Philadelphia schedule. Commercial lights will cost ten cents.

TOLEDO, OHIO.—President George B. Kerper, of the Toledo, Bowling Green & Southern Railway has closed a 30-day contract with the Toledo Railways & Light Company whereby his cars will be permitted to use the city company's tracks to the center of the city.

ZANESVILLE, OHIO.—Mayor Holden has announced that in the future he will enforce the "blue laws" and stop Sunday street cars in the city. Manager Gibbs, of the Zanesville Street Railway, has announced he will resist the order and carry the matter into the courts if necessary.

YOUNGSTOWN, OHIO.—Directors of the Youngstown & Sharon Railway met Jan. 7, and voted to issue $1,000,000 in bonds to be used in building the New Castle-Sharon line, in establishing a park near Sharon, to double track a portion of the present line, and to make general improvements.

YOUNGSTOWN, OHIO.—Employes of the Mahoning Valley Railway have received an increase in wages. They will receive 17 cents an hour for six months, 18 cents for the second six months and 19 cents after one year. Heretofore wages have been increased only after two years of service.

CINCINNATI, OHIO.—The Cincinnati, Georgetown & Portsmouth Railway, which is to be changed for electric propulsion, has placed a contract with the St. Louis Car Company, St. Louis, for ten passenger and three combination coaches. Ninety miles of wire and other material have also been contracted for.

COLUMBUS, OHIO.—It appears that the consolidation of the Columbus, Delaware & Marion Railway and the Columbus, Delaware & Northern Traction Company is being held up because of a disagreement over the purchase of the Delaware Street Railway, on which the latter company holds an option.

NEWARK, OHIO.—L. C. Taylor and John S. Black, promoters of the Columbus, Newark, Zanesville & Wheeling Traction Company, state that arrangements have been made with New York banking houses to furnish money to construct the road, and it is claimed that actual work will start in the spring.

COLUMBUS, OHIO.—General Axline, promoter of the Urbana, Mechanicsburg & Columbus Traction Company, announces that the company has been reorganized with new capital, and that all debts of the old company will be settled at once. Work will be resumed by a new contractor in a very short time.

CANTON, OHIO.—The Canton-Akron Railway Company has filed a mortgage for $1,000,000 given to the Knickerbocker Trust Company of New York. The money obtained will be used in completing the road. When fully completed the property will become a part of the system of the Northern Ohio Traction Company.

CINCINNATI, OHIO.—M. J. Mandelbaum, of the Southern Ohio Traction Company, and a prominent backer of the Fordyce scheme of canal-boat propulsion, reports 90 per cent of the grade completed and 50 per cent of the pole line, and says the line between Cincinnati and Dayton will be in operation by April 1.

CLEVELAND, OHIO.—Secretary Lang, of the Southern Ohio Traction Company, has issued a call for a meeting of the stockholders to be held in Hamilton, Feb. 3, to consider and vote on the proposition to buy out the Hamilton & Lindenwald Electric Transit Company and the Miamisburg & Germantown Traction Company.

EAST LIVERPOOL, OHIO.—The East Liverpool Street Railway Company is building an extension to Smith's Ferry and will have it in operation about April 1. The company is making extensive improvements to its power-house. A transformer will be installed so that the lighting plant can be used for emergency purposes.

CLEVELAND, OHIO.—The Citizens' Street Railway of Mansfield has filed a mortgage for $400,000 in favor of the Cleveland Trust Company to cover bonds to the same amount issued for the purpose of building the Mansfield-Shelby line (already completed), for making improvements to the present system and for liquidating bonded indebtedness.

SALEM, OHIO.—The Salem Electric Railway and the Salem Electric Light & Power Company have arranged to consolidate and the new company will be known as the Salem Traction Company. The two companies have practically been under the same management for some time. The city franchise has been extended and improvements will be made.

CANTON, OHIO.—Superintendent Douglass, of the Canton-Massillon division of the Northern Ohio Traction Company, has received instructions to continue the work of improving the city and suburban lines under his charge. The Northern Traction Company is in excellent financial condition and will not be affected by the embarrassment of the Everett-Moore syndicate.

CLEVELAND, OHIO.—The three cent fare ordinance proposed by Councilman Howe at the instigation of Mayor Tom L. Johnson was passed by the City Council under suspended rules January 6. It provides for the granting of franchises over numerous city routes on a basis of three cent fares. The routes will be advertised and bids asked for at once. Mayor Johnson claims he is assured of several bids.

MIAMISBURG, OHIO.—The Miamisburg Council has adopted a unique method of determining the speed of traction cars and trains passing through the town. The ordinance calls for a speed of six miles an hour and a man who

can walk at this gait has been employed to keep tab on the cars and trains. He walks along the track, and in event he can not keep up with the object in question, he reports to the Council.

DELAWARE, OHIO.—Farmers of Delaware County have organized the Delaware, Berkshire & Sunbury Electric Railway Company. Officers have been elected as follows: Col. W. H. Knauss, president; E. F. Gwynn, vice-president; J. M. Gamble, secretary-treasurer; J. E. Bierbower, general manager; J. T. Adams, superintendent of construction; J. M. Loren, attorney. Power will be furnished temporarily by the Delaware lighting plant.

RIPLEY, OHIO.—The Ripley, Georgetown, Hillsboro & Columbus Electric Railway Company has organized by electing officers as follows: President, G. Baubach, of Ripley; vice-presidents, J. W. Marshall, of Sardinia, and Albert Krutz, of Georgetown; secretary, John R. Moore, of Georgetown; treasurer, E. E. Galbraith, of Ripley. The syndicate which proposes to finance the road has advised that the right of way be secured at once and the money would be forthcoming.

CLEVELAND, OHIO.—At a meeting held in Toledo Jan. 13, between the Strang Construction Company, contractors for the Detroit & Toledo Shore line, the receivers in charge of the property and representatives of the Cleveland bankers' committee, all differences with the construction company were settled. By the terms of the settlement, the Strang company's claim of $280,000 will be satisfactorily settled at an early date, and the work of completing the road will be pushed. As the matter now stands, Receiver Allen E. Edwards, who was appointed at the instigation of the Cleveland bankers, will have practical control of the road.

CLEVELAND, OHIO.—Stockholders of the Cleveland Electric Railway have received their regular quarterly dividend of 1 per cent. The annual report of the company shows that the road had a very prosperous year. The company has earned all its fixed charges, operating expenses, a four per cent. dividend and over $500,000 that went to pay for improvements and new equipment. In 1900 the company paid 51.38 per cent of its earnings for expenses and taxes, while in 1901 the figures were 55.13. The annual meeting will be held later, when a proposition to increase the capital stock $1,000,000 will be voted on. In view of the embarrassment of the syndicate, it is believed that the proposition will be voted down.

OTTAWA, ONT.—It is reported that the Westinghouse Electric Manufacturing Company is behind the scheme to build an electric railway between the city of Winnipeg, Man., and the town of Headingly.

TORONTO, ONT.—The receipts of the Toronto Electric Street Railway Company, during the year 1901, were largely in excess of those of the previous year, every month showing a substantial increase. The total receipts were $1,636,861, which was $152,263 over 1900.

HAMILTON, ONT.—Mr. Henry T. Therbur, of Detroit, Mich., is head of a syndicate which purposes constructing and operating an electric railway system with the city of Hamilton as its centre, and Galt, Guelph, Berlin and other cities and towns in that section of the province as places to be reached.

PITTSBURG, PA.—On Jan. 17 the details were completed for the consolidation of the Connellsville & Suburban Street Railway and the Yioughiogheny Light, Heat & Power Company, of Connellsville, Pa., with the Pittsburg, McKeesport & Connellsville Railway Company. By the merging of these companies parallel railroad lines between McKeesport and Connellsville will be discontinued.

NASHVILLE, TENN.—The Suburban Street Railway has been incorporated to extend an electric railway out Church Street. The authorized capital is $50,000. Incorporators Thos. J. Felder, B. F. Wilson and others. Later the road may be extended to West Nashville.

MILWAUKEE, WIS.—A new electric railway project has taken form and the Common Council will shortly be asked for a franchise.

THE AUTOMOBILE.

THE UNION AUTOMOBILE COMPANY, of Union City, Ind., has completed new buildings and modern machinery is now being placed for the manufacture of automobiles. The company expects to turn out 500 machines this year.

TO TOUR EUROPE.—Dr. Harry Hicks, of Indianapolis, Ind., has arrangements almost completed for a trip through Europe in an automobile—a new Winton gasoline touring car, especially constructed for long-distance journeys. Dr. Hicks will leave Indianapolis soon after the automobile show and will be gone three months.

RIGHTS OF AUTOMOBILES.—The Indiana Supreme Court has decided that the automobile has an equal right with other vehicles on the public highways, and that the horse has no exclusive right to the road, and injuries caused by "spillouts" and "runaways" as the result of frightening horses does not give the injured party a right of action, provided the operators of the automobile take proper precaution to prevent fright.

INDIANAPOLIS AUTOMOBILE SHOW.—Considerable interest is manifested in the automobile show to be held in Indianapolis, Ind., Feb. 17 to 22. All of the large floor space of Tomlinson Hall has been taken and the exhibits will be attractive. Sundries of all kinds will be exhibited. Everything from a 140-lb. motor to the semi-racers, that weigh 2,000 lbs., and big trucks will be exhibited. The show promises to be a great success. All the owners of automobiles in Indiana have been invited to meet in Indianapolis during the show to form a State association. The object set forth is to promote good roads and break down the prejudice which exists in some quarters against motor vehicles. An annual run over Indiana roads and a race meet are suggested.

NEW INDUSTRIAL COMPANIES.

THE ROGERS ELECTRICAL WORKS COMPANY has been incorporated in Jersey City, N. J.; capital, $100,000. Incorporators: John C. Henriques, Nathan Silverman and Walter Blake.

THE CONRAD MUELLER COMPANY, of Indianapolis, with $10,000 capital, has been incorporated to deal in electric vehicles. The incorporators are Conrad Mueller, Peter H. Goodall and Charles F. Reid.

THE COLUMBIA ELECTRIC & MANUFACTURING COMPANY, of Newark, N. J., has been incorporated; capital, $125,000. Incorporators: W. Harvey Jones, Martin K. Robinson and George M. Lane.

THE STANLEY ELECTRIC MANUFACTURING COMPANY has been incorporated under the laws of the State of California, with Trenton, N. J., as the principal place of business. Directors: F. O. Briggs, W. B. Gandy, L. C. Taylor, E. W. Taylor, J. H. Janeway, W. A. Andersorf and D. M. Anderson. Capital stock, $2,000,000.

THE WILMINGTON ELECTRIC SUPPLY & CONSTRUCTION COMPANY has been incorporated at Wilmington, N. C., with an authorized capital of $25,000. John Frank, W. H. Howell and others are interested. The company will deal in general electrical supplies, and do a general electric and mechanical construction business.

LOCOMOBILE COMPANY.—A general meeting of the stockholders of the Locomobile Company of America will be held Feb. 11 at the offices of the company, 7 East Forty-second Street, New York City. A resolution will be presented to the stockholders authorizing the issuance of $500,000 of 7 per cent preferred stock to take the place of the same amount of common stock of the company.

LEGAL.

PAN-AMERICAN.—Judgment for $3,130 has been obtained against the Pan-American Exposition Company of Buffalo in favor of the Mayo-Rohrer Company, of New York, for arc lamps, globes and spark arresters.

IN FAVOR OF WESTERN UNION.—The United States Circuit Court of Appeals has made an order directing the Boston Safe Deposit & Trust Company to pay over to the Western Union Telegraph Company $35,786. This money was held in trust by the Boston company as mortgagees of certain minor telegraph lines which the Western Union has purchased and absorbed.

INSTRUMENT LITIGATION.—The Whitney Electrical Instrument Company has answered the bill of complaint of the Weston Electrical Instrument Company in the New York United States Court. It denies the charge of infringement upon the Weston patents and declares them void, because of the prior use of the same ideas in electrical measuring instruments by Elihu Thomson and Charles F. Brush.

BOSTON EDISON LIABILITY.—A concession of liability by the Edison Electric Illuminating Company, in the subway explosion of March 4, 1897, in which a dozen persons were killed and scores were injured, promises to end speedily a mass of litigation for damages involving claims aggregating nearly $1,500,000. Previously the courts had found the Boston Gas Light Company and the Edison Company jointly liable, but the Edison Company had contested the finding. From time to time the case has been postponed in view of the possibility of a settlement, and this week, when the damage cases are called in court, on continuance, the announcement will be made that the Edison Company concedes liability with the Gas company. It is thought that this action will mean the payment of at least $500,000 of the damage claims by the Edison Company. The explosion was said to have been caused by a spark from electric light wires igniting gas which had leaked from the Gas company's pipes into the subway excavation at the corner of Tremont and Boylston Streets. The excavations, it would appear, strained the electric underground mains.

PERSONAL.

PRESIDENT C. A. COFFIN, of the General Electric Company, has sailed for England.

DR. LOUIS DUNCAN has, we regret to note, been seriously ill lately, but favorable reports are issued by his physicians.

DR. N. S. KEITH, the well known electrical engineer, mining expert, etc., has established offices at 95 Liberty Street, where he will practice his profession.

MR. C. T. YERKES has sailed again for England, in furtherance of his work in completing the electrification of the London Metropolitan underground system.

MR. J. G. WHITE is a fairly well man again and has been able to visit his offices. He is now enjoying life once more by spending a few weeks among the Lakewood pines.

MR. R. S. MASSON has resigned the position of superintendent of the Independent Electric Light & Power Company, San Francisco, and has opened an office as a consulting electrical engineer.

MR CHARLES S. DRUMMOND, one of the prominent directors of the British Electric Traction Company, who has been on a visit to this side for the past five weeks, has sailed for Europe. Mr. Drummond's sojourn on this occasion was principally made in connection with the British Columbian properties of his company, who control the leading electric traction systems in Vancouver and Nelson, B. C.

MR. G. MARCONI sailed for Southampton on Jan. 22, on the "Philadelphia," which has been equipped with a set of his apparatus. He was the recipient of many attentions and courtesies while in New York, including lunch with Mr. Andrew Carnegie, a dinner party at Mr. John Bottomley's, etc. He expects to return to this side in a short time and to continue the important work that has recently attracted so much attention.

MR. J. B. OLSON.—It will be of great interest to many of our readers and to the insulated wire industry in general to learn that Mr. James B. Olson has now been appointed manager of sales for the India Rubber & Gutta Percha Insulating Company, of Yonkers and New York City. For many years previous to this Mr. Olson was associated there with the late James W. Godfrey, whose recent tragic death aroused such deep feelings of regret throughout the electrical industry. The faithful portrait which accompanies the present notice is that of a young man who has an unusually wide acquaintance East and West. Mr. Olson was originally associated with Mr. Godfrey in the firearms business as far back as 1879, and afterwards followed him into the insulated wire trade, becoming connected with the New York Insulated Wire Company in 1887, and representing that concern as Western sales agent in Chicago around 1893, the year of the World's Fair, when so many electrical people visited Chicago. Owing to the illness of his wife, Mr. Olson found it necessary to return East and he became associated with the Habirshaw interests in 1894. His succession to the work and duties of the late Mr. Godfrey is regarded not only as a logical occurrence, but as a well-deserved promotion. Mr. Olson, during the many years of his experience in the insulated wire industry, has devoted his time and energies not only to the building up of a successful trade connection, but to the mastery of the many intricate technical details which are of such vital importance in view of the wider ramifications yearly of electric light and power. His name now appears upon the literature of the concern, and his well-known chief, Dr. W. M. Habirshaw, the general manager of the company, is to be congratulated upon the continuance in his service of one who has already become so favorably known, and whose large circle of friendship and acquaintance must inure to the welfare of the interests which he will now represent in the New York City office.

J. B. OLSON.

MR. ARTHUR B. PROAL, JR., has resigned his position as chief engineer of the New York & Staten Island Electric Company, Livingston, L. I.

MR. R. B. BRANWELL, who has resigned his position with the De Dion-Bouton Motorette Company, succeeds Mr. W. C. Stuart as manager of the advertising department of the International Motor Car Company.

MR. ST. JOHN MILDMAY, a nephew of Mr. Gisbert Kapp, is visiting this country. He is representing while here the *Corriere della Sera* of Milan, and was one of the participants in the Marconi dinner last week.

DOBBS-DODGE.—The marriage is announced at Ravenna, Ohio, on Jan. 7 of Miss Cora M., daughter of Mr. and Mrs. H. M. Dodge, to Mr. A. E. Dobbs, the well known telephone expert, writer, etc., who is now making his residence in New York City.

MR. FRANK B. RAE, the electrical and mechanical engineer, has removed his office to Exchange Court, 52 Broadway, where he will have increased office facilities for his work in connection with lighting, railway and power transmission enterprises.

MR. CHAS. L. GOODMERE has resigned as superintendent of the Atlantic Coast Telephone Company to accept the position of chief engineer of the United Telephone & Telegraph Company, of Philadelphia. He will, however, continue to reside at Atlantic City, N. J.

MR. A. W. HUTCHINS, for several years connected with the Narragansett Electric Lighting Company at Providence, R. I., has retired from his position with that company to take charge of the sales department of the Acme Switch Company, Hartford, Conn., maker of the Acme time switch.

MR. J. W. MASON, formerly traveling salesman in the States of Illinois, Kansas, and Missouri for the Central Electric Company, of Chicago, has recently been appointed to the position of general salesman for the same company, with headquarters at its Chicago office. Mr. Mason is well known to the electrical trade throughout the West, and his many friends will wish him success.

MR. P. C. BURNS, president of the American Electric Telephone Company, in an interview with a representative of ELECTRICAL WORLD AND ENGINEER, stated in connection with the matters of the Everett-Moore syndicate that all the properties investigated so far have been found to be profit-bearing enterprises, and that the affairs of the company will undoubtedly be straightened out satisfactorily without anything more than temporary embarrassment.

MR. D. THOMSON, a brother of Prof. Elihu Thomson, is now president and manager of the Thomson Electrical Company, Manhattan Building, Chicago. He has had a long experience in the field, being over six years superintendent of the lighting department of the Royal Electric Company of Montreal; two and a half years manager of the Hamilton, Ont., Light & Power Company; two and a half years in management of the Ithaca Street Railway and Lighting Company; two and a half years president and manager of the Hannibal, Mo., Railway Company, and one year manager of the Dubuque street railway system. The new company is making several of his specialties and is also engaged in electrical engineering.

MR. CALVIN W. RICE, of the New York Edison Company, and chairman of the Committee of Papers and Meetings of the American Institute of Electrical Engineers, presented an interesting paper on the Nernst Lamp before the Brooklyn Engineers Club on the evening of Thursday, Jan. 9. Mr. Rice's familiarity with his subject and the numerous examples of American and foreign samples of lamps, which he was enabled to exhibit in operation, resulted in giving to the members of the club one of the pleasantest evenings of the season. He also gave an address on the Utilization of Electricity in Mining before the Boston Society of Arts on Jan 23.

Trade Notes.

DELTA METAL.—The Phosphor-Bronze Smelting Company, Limited, 2200 Washington Avenue, Philadelphia, has issued its January price list of its Delta metal.

EXHAUST HEADS AND STEAM TRAPS are the subject of Catalogue No. 119 of the B. F. Sturtevant Company, Boston, Mass. Tables give the dimensions, weight and prices of the different sizes of these devices, both of which are illustrated.

THE ELECTRIC APPLIANCE COMPANY, Chicago, reports that the new type alternating current Gutmann wattmeter brought such an avalanche of orders that it has found it hard to keep up with them. It is now in shape to fill all orders promptly.

OFFICERS ELECTED.—At the annual meeting of stockholders of the Warren Electric & Specialty Company held a few days ago, the directors were all re-elected. Officers were chosen as follows: President, T. H. Gillmer; vice-president, C. H. Angstadt; secretary-treasurer, E. W. Gillmer.

STEEL WHEEL-BARROWS.—In the construction of electric plants the prosaic wheel-barrow is an important implement. Wheel-barrows, carts, wheels, etc., are manufactured by the Archer Iron Works, Chicago, Ill., and a complete line of such implements is described and illustrated in a pamphlet recently issued by the works.

DYNAMOS AND MOTORS.—The protected type direct current dynamos and motors, manufactured by the Robbins & Myers Company, Springfield, Ohio, are illustrated and briefly described in Circular No. 21, issued by that company. This line of machines has been on the market for several years and is well known. The machines possess many points of merit, and are well designed and compact.

THE CENTRAL ELECTRIC COMPANY of Chicago will be pleased to quote on application prices on I. X. L. weatherproof, slow-burning, and slow-burning weather-proof wire, office, annunciator, magnet, and galvanized telephone wire. The Central Electric Company will also gladly furnish prices on Okonite insulated wires and cables for ærial, submarine, and for general use where an insulated wire is required.

T. J. MOSHER ELECTRIC COMPANY.—On Jan. 1 the name of the company established in Grand Rapids, Mich., by T. J. Mosher, under the style Furniture City Electric Company, was changed to the T. J. Mosher Electric Company. The company will conduct a general electrical contracting and repairing business, and will manufacture gas and electric fixtures. The company's headquarters are in the Michigan Trust Building, Grand Rapids.

"TERSE TELEPHONE TALK" is the title of a 24-page pamphlet just issued by the Kellogg Switchboard & Supply Company, Chicago, Ill. The text consists of a review of the independent telephone movement, which is followed by a general description of Kellogg apparatus. The pamphlet is liberally illustrated, ten full page illustrations giving views of the Kellogg Company's exhibit at the Pan-American Exposition. On the front cover is shown a telephone line, the cross arms of three of the poles forming the letter T, which combination constitutes the first letter of the words of the title, "Terse Telephone Talk."

THE HAINES & NOYES COMPANY, 118-132 West Jackson Boulevard, Chicago, which makes a specialty of apparatus for private telephone plant use, has increased its capital to meet growth and made a number of changes in its factory. In consequence it is equipped to turn out the best apparatus at lowest figures. It manufactures telephones for every possible use, and makes up special telephones for mines which are waterproof and damp proof, as well as telephones for electric and steam railways, office buildings, hotels, private residences, etc. Its 1902 catalogue has just been issued, and is most complete one in every detail. It is full of excellent half-tones and very complete descriptions of all the company's apparatus. It may be had for the asking.

THE GAMEWELL FIRE ALARM TELEGRAPH COMPANY last March sent its Pacific Coast representative, Mr. A. J. Coffee, on a business tour of our new possessions in the Pacific Ocean. As a result of this enterprise, a fire alarm and police telegraph system is now being installed in Honolulu, H. I., under Mr. Coffee's supervision, and work will be commenced as soon as plans and materials can be forwarded, on a similar installation in Manila. The Honolulu contracts amount of $40,000, and comprise all the details of thoroughly modern fire and police equipments, including a 300-cell storage battery. Two of the latest type of police patrol wagons are being built, in San Francisco, for the Honolulu police department. The contracts for the fire and police telegraph systems for Manila, P. I., will amount in the aggregate to $74,000.

THE EDUCATION OF MECHANICS.—One of the prime reasons for failure on the part of men who have without assistance endeavored to advance themselves along any particular branch of study is that few are willing to start at the bottom and work along well defined lines. The tendency is to skim over the elementary lessons and jump at once to some point where the student would like to be. The result is that the beginner finds himself in "deep water" and probably gives up too soon, feeling that the subject is too much for his comprehension. As a matter of fact, had he been given only a limited amount of elementary study at one time, and been allowed to thoroughly digest it before proceeding, the road would have been comparatively easy. This is where the American School of Correspondence, Boston, Mass., for example, has proved so beneficial to those who have been deprived of the advantages of an education. Not so many years ago, when books were very expensive and papers few, it was quite a difficult thing for a poor man to advance himself even along the line of his occupation, and to change his business for some other which he felt he was more fitted for was almost impossible. The work in which he accidentally found himself was usually that which he was forced to follow, for no other than the simple, though it might be said tragic, reason that he had not the money to attend some college. To-day, however, a man with a very limited capital, coupled with a desire to be something more than he is, can, without leaving his work, join the ranks of a correspondence school and master almost any branch which is worthy of study.

Record of Electrical Patents

UNITED STATES PATENTS ISSUED JAN. 14, 1902.
[Conducted by Wm. A. Rosenbaum, Patent Attorney, 140 Nassau St., N. Y.]

690,928. LAMP SOCKET; H. P. Clausen, Chicago, Ill. App. filed April 1, 1901. Means for mounting the supervisory lamps in a telephone switchboard, consisting of spring plates serving as sockets and circuit terminals, are secured to brackets attached to the keyboard. The lamps are easily inserted between the spring plates and removed therefrom.

690,946. PUSH BUTTON SWITCH; M. Guett, Hartford, Conn. App. filed Sept. 23, 1901. Details.

690,952. INCANDESCENT ELECTRODE VAPOR ELECTRIC LAMP; P. C. Hewitt, New York, N. Y. App. filed April 18, 1900. (See page 167.)

690,953. METHOD OF ELECTRIC LIGHTING; P. C. Hewitt, New York, N. Y. App. filed April 18, 1900. (See page 167.)

690,958. METHOD OF ELECTRIC WELDING; R. M. Hunter, Philadelphia, Pa. App. filed April 7, 1898. Sheet material is welded together by placing two sheets in contact at a large number of small independent points arranged in the line of the weld, then passing a current through the joint and pressing the parts together.

690,966. CLAMP FOR RAIL JOINTS; W. S. Jones, Chicago, Ill. App. filed June 6, 1901. To avoid passing bolts through the ends of the rails, the fish plates extend beneath the rail and are clamped together at that location. For insulating purposes plates of insulating material are inserted between the fish plates and the rail.

690,973. ROTARY CIRCUIT BREAKER; A. R. Luschka, Chicago, Ill. App. filed Aug. 22, 1901. A hollow vessel shaped like a top and opening at the bottom into a body of mercury, rotates, and by centrifugal force causes the mercury to rise in the vessel and flow outward in a steady stream from an opening at the top against contact plates spaced around the vessel, to thus make and break a circuit through the mercury stream.

690,976. SOCKET FOR INCANDESCENT LAMPS; N. Marshall, Newton, Mass. App. filed Aug. 8, 1900. The contact pieces and parts of the switch are set into cavities formed in a solid block of porcelain.

691,007. MAGNETIC SEPARATOR; F. A. M. Schiechel, Frankfort-on-the-Main, Germany. App. filed Nov. 26, 1898. The magnet poles are arranged so that the magnetic field is created between one north pole and two south poles; the material is supplied to the north pole where the magnetic field is most concentrated, with the result that no material can adhere to the south poles and the stripping belts commonly used can be dispensed with.

691,024. BATTERY CHUTE OR WELL; E. W. Vogel, Chicago, Ill. App. filed Nov. 5, 1900. A pipe sunk into the ground, closed at its lower end and having a cover at its upper end and a lateral opening below the cover, for the circuit wires which lead from the cells in the pipe. The cells are placed one above the other.

691,060. TELEPHONY; Isidor Kitsee, Philadelphia, Pa. App. filed April 15, 1901. (See page 167.)

691,101. PROCESS OF REGAINING TIN; P. Bergsoe, Copenhagen, Denmark. App. filed May 10, 1900. (See Current News and Notes.)

691,144. APPARATUS FOR CHARGING BATTERIES; M. R. Hutchison, New York, N. Y. App. filed July 19, 1901. A charging cord having a plug at one end for insertion into a lamp socket, and having two like connecting plugs at the other end; each connecting plug having a male and a female part, the male part of one plug being connected to the positive cord and the male part of the other plug connected to the negative cord, the female parts of both being connected to opposing cords. Having first obtained the polarity of the source of current by using these plugs successively on a polarity indicator, the proper plug is then connected with the battery for charging.

691,158. ELECTROLYTIC SOLUTION; O. Meyer, Richmond, Va. App. filed Aug. 22, 1901. (See Current News and Notes.)

691,176. ELECTRIC TELEGRAPH APPARATUS; P. Picard, Paris, France. App. filed Feb. 12, 1898. A key connected with two oppositely disposed batteries sends current first from one and then the other of the batteries through two polarized relays and a condenser, in series. The battery circuits are thus closed alternately and the corresponding relay sends a current of corresponding polarity over the line. At the receiving station each alternate impulse energizes the recorder.

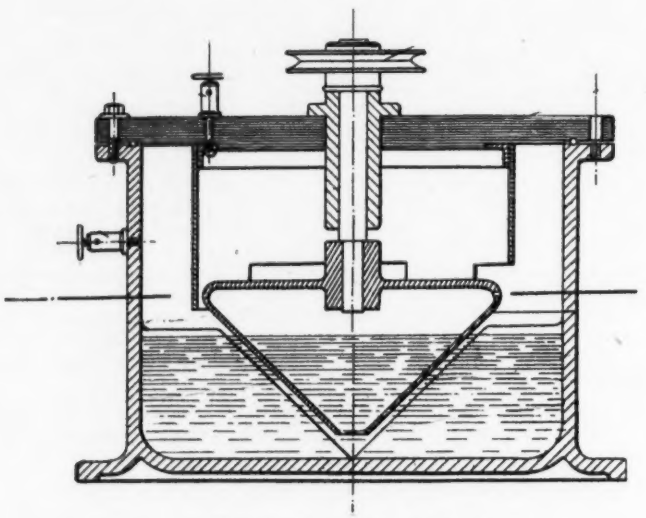
691,187. SWITCH MECHANISM FOR ELECTRIC MOTORS; A. W. Schramm, Philadelphia, Pa. App. filed Oct. 30, 1899. Contacts connected to various sub-divisions of a resistance permanently connected between the field terminals, and a potential-selecting brush and connections whereby the potential at the armature is represented by the potential difference between the ends of one or more of the sub-divisions of the resistance.

691,188. MEANS FOR REGULATING ELECTRIC MOTORS; A. W. Schramm, Philadelphia, Pa. App. filed Oct. 30, 1899. A speed changing mechanism employing in series with the shunt field of the motor, a number of reverse windings or resistances, which may be successively short-circuited or put in circuit.

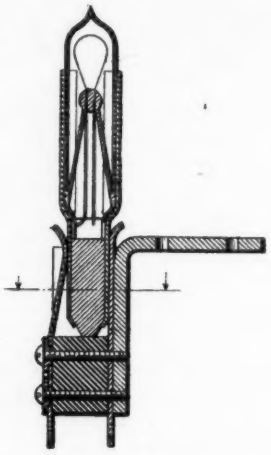
691,197. FIRE ALARM APPLIANCE; D. T. Spring and A. Long, Wheeling, W. Va. App. filed Sept. 24, 1901. Details.

691,229. INDIVIDUAL TELEPHONE SWITCH AND LOCK-OUT MECHANISM FOR INTER-CONNECTING LINES; Albert K. Andriano and Hermann Herbstritt, San Francisco, Calif. App. filed April 19, 1900. (See page 167.)

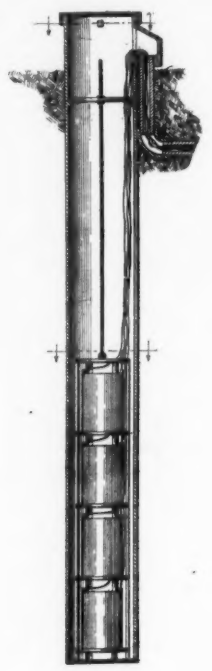
691,236. TROLLEY POLE BASE; J. D. Buckley and E. H. Phinney, Brunswick, Me. App. filed April 22, 1901. A hood in which the end of the trolley pole and its spring are housed, is mounted to turn on roller bearings on the base piece fixed to the top of the car.



690,973.—Rotary Circuit Breaker.



690,928.—Lamp Socket.



691,024.—Battery Chute or Well.

691,245. TELEPHONE CIRCUIT; Walter K. Cook, Mason City, Ia. App. filed Aug. 5, 1901. (See page 167.)

691,262. MAGNETIC SEPARATOR; G. Grondal, Pitkaranta, Russia. App. filed April 14, 1900. Small magnetic blocks are set into a non-magnetic apron over which the material passes; the particles to be separated are caused to turn as they move from one block to the next on account of the difference of polarity between the adjacent edges of the blocks.

691,263. TROLLEY TENDER; A. W. Ham, Lansingburg, N. Y. App. filed April 8, 1901. A spring drum upon which the trolley cord is wound.

691,264. TROLLEY TENDER; A. W. Ham, Lansingburg, N. Y. App. filed June 13, 1901. A modification of the preceding patent.

691,275. TROLLEY POLE CONTROLLING DEVICE FOR CARS OR VEHICLES; W. H. Kilbourd, Greenfield, Mass. App. filed April 10, 1901. The trolley cord passes around a weighted pulley arranged on an inclined track. When the trolley leaves the wire, the pole is retarded by the weight.

691,281. TELEPHONE SYSTEM; Frank E. Mayberry, Medford, Mass. App. filed March 18, 1901. (See page 167.)

691,298. TRANSMITTING ELECTRIC CURRENTS; A. A. E. Sterzing, New York, N. Y. App. filed Aug. 11, 1900. (See Current News and Notes.)

691,313. BONDING PIN AND METHOD OF MAKING SAME; C. A. Holdridge, Chicago, Ill. App. filed Nov. 18, 1901. A conical hollow pin adapted to fit over the end of the bond and be driven into the hole in the rail, is made by placing together two semi-conical parts.